

AD-A156 527

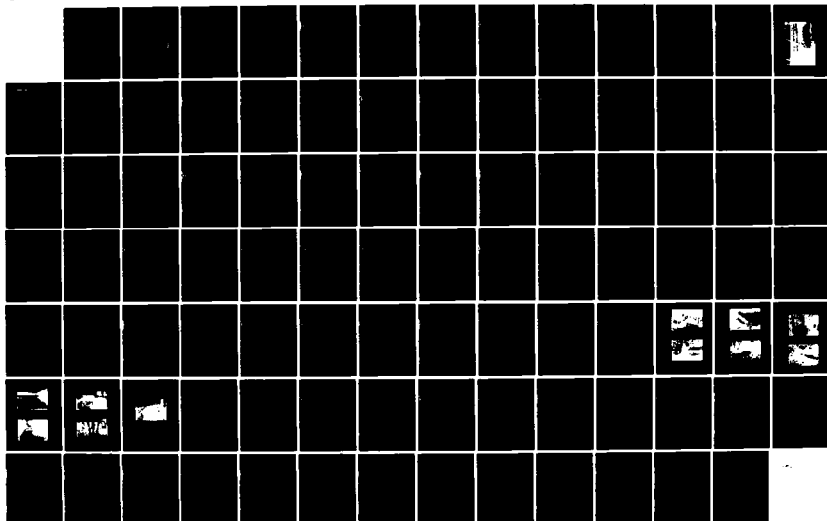
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
SPAULDING DAM (NH-003) (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV APR 79

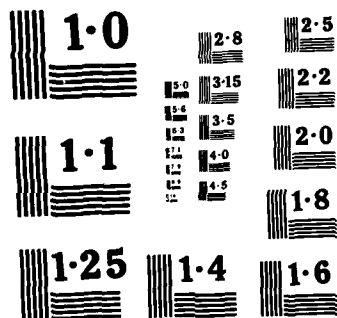
1/1

UNCLASSIFIED

F/G 13/13

NL





NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

AD-A156 527

PISCATAQUA RIVER BASIN
ROCHESTER, NEW HAMPSHIRE

3985-
NH

SPAULDING DAM
NH-00390

FEDERAL ENERGY REGULATORY COMMISSION
RECEIVED

NOV 29 1984

NEW YORK, N. Y.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DTIC
ELECTE
JUL 11 1985
S D G



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

DTIC STATEMENT A
Approved for public release
Distribution Unlimited

APRIL 1979
DTIC FILE COPY 85 6 19 076

DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DTIC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NH 00390	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Spauldings Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE April 1979
		13. NUMBER OF PAGES 74
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Piscataqua River Basin Rochester, New Hampshire Salmon Falls River		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is a stone masonry gravity dam with earth embankment dikes. The dam is about 30 ft. high and 157 ft. long. The dam is assessed to be in fair condition. Concerns include low areas in the embankments which are susceptible to erosion and overtopping. The dam is small in size with a significant hazard potential. The owner should retain the services of a qualified engineer and implement the results of the hydrology of the watershed and hydraulics of the dam. Other remedial measures must also be implemented.		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

JUN 25 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Spaulding Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

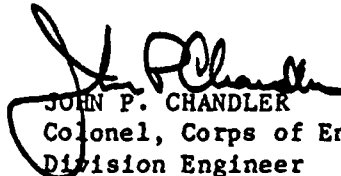
A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Spaulding Fibre Company, Spaulding Avenue, North Rochester, New Hampshire 03867.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

Incl
As stated


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

PISCATAQUA RIVER BASIN
ROCHESTER, NEW HAMPSHIRE

SPAULDING DAM

NH-00390

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A/	



NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

NH-00390

SPAULDING DAM

ROCHESTER

STRAFFORD COUNTY, NEW HAMPSHIRE

SALMON FALLS RIVER

November 14, 1978

BRIEF ASSESSMENT

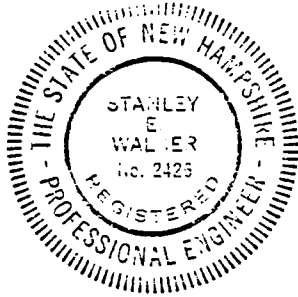
The Spaulding Dam is a stone masonry gravity dam with earth embankment dikes. The dam is about 30 feet high. The masonry spillway section is about 157 feet long. The dam is situated in a broad, flat section of the Salmon Falls River valley.

Based on the visual inspection, available drawings and past operational performance, the Spaulding Dam is assessed to be in fair condition. Concerns regarding the long term safety of the dam include low areas in the embankments which are susceptible to erosion and overtopping, and lack of accessibility to some of the stop log bays in the spillway.

The dam is a small-size dam and is classified as having a significant hazard potential. In accordance with Corps of Engineers' Guidelines for Safety Inspection of Dams, the test flood is one-half the probable maximum flood. The test flood is estimated at 20,700 cfs. In its present condition the spillway can pass about 40% of the 1/2 PMF. The test flood would overtop the dam by about 4 feet.

Within two years, the owner should retain the services of a registered professional engineer and implement the results of his evaluation of the hydrology of the watershed and hydraulics of the dam. This study should evaluate the need for increased spillway capacity, and its findings should be implemented. The embankment portions of the dam should be repaired where eroded, raised to a uniform elevation with appropriate materials, and riprapped and/or turfed with an erosion resistant vegetative cover and a program of complete or selective tree cutting should be investigated. The

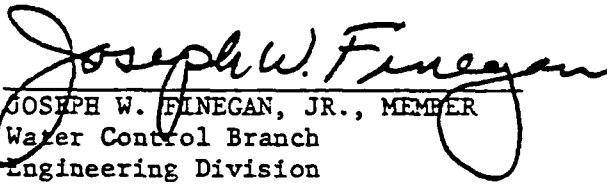
following items of remedial maintenance, presented in Section 7, should be implemented within 1 year after receipt of this report by the owner: 1) repair and reestablishment of a uniform crest elevation at embankment sections; 2) repair of deteriorated concrete; 3) replacement of the north section of the service bridge; 4) monitoring of seepage; 5) repair or replacement of deteriorated timber gate lift stems at the controlled outlet; 6) implementation of a surveillance and warning system; and 7) implementation of a program of biennial periodic technical inspection of the structure.

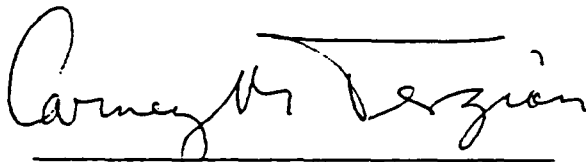


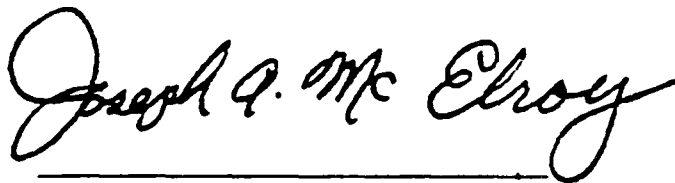
EDWARD C. JORDAN CO., INC.

Stanley E. Walker
Stanley E. Walker, P.E.
Project Officer

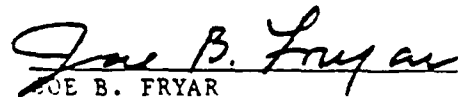
This Phase I Inspection Report on Spaulding Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.


JOSEPH W. FLANAGAN, JR., MEMBER
Water Control Branch
Engineering Division


CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division


JOSEPH A. MCELROY, CHAIRMAN
Chief, NED Materials Testing Lab.
Foundations & Materials Branch
Engineering Division

APPROVAL RECOMMENDED:


JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Recommended Guidelines for Safety Inspection of Dams, the spillway test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

	<u>PAGE</u>
LETTER OF TRANSMITTAL	
BRIEF ASSESSMENT.....	i
REVIEW BOARD SIGNATURE SHEET.....	iii
PREFACE.....	iv
TABLE OF CONTENTS.....	vi
OVERVIEW PHOTOGRAPH.....	viii
LOCATION MAP.....	ix

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL.....	1-1
1.2 DESCRIPTION OF PROJECT.....	1-2
1.3 PERTINENT DATA.....	1-7

SECTION 2 - ENGINEERING DATA

2.1 DESIGN.....	2-1
2.2 CONSTRUCTION.....	2-1
2.3 OPERATION.....	2-1
2.4 EVALUATION.....	2-2

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS.....	3-1
3.2 EVALUATION.....	3-7

SECTION 4 - OPERATING PROCEDURES

4.1 PROCEDURES.....	4-1
4.2 MAINTENANCE OF DAM.....	4-2
4.3 MAINTENANCE OF OPERATING FACILITIES.....	4-2
4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT.....	4-3
4.5 EVALUATION.....	4-3

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES.....	5-1
---------------------------------	-----

TABLE OF CONTENTS (Continued).

SECTION 6 - STRUCTURAL STABILITY

6.1	EVALUATION OF STRUCTURAL STABILITY.....	6-1
-----	---	-----

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1	DAM ASSESSMENT.....	7-1
7.2	RECOMMENDATIONS.....	7-2
7.3	REMEDIAL MEASURES.....	7-2

APPENDICES

A	FIELD INSPECTION NOTES
B	ENGINEERING DATA
C	PHOTOGRAPHS
D	HYDROLOGIC AND HYDPAULIC COMPUTATIONS
E	INVENTORY FORMS

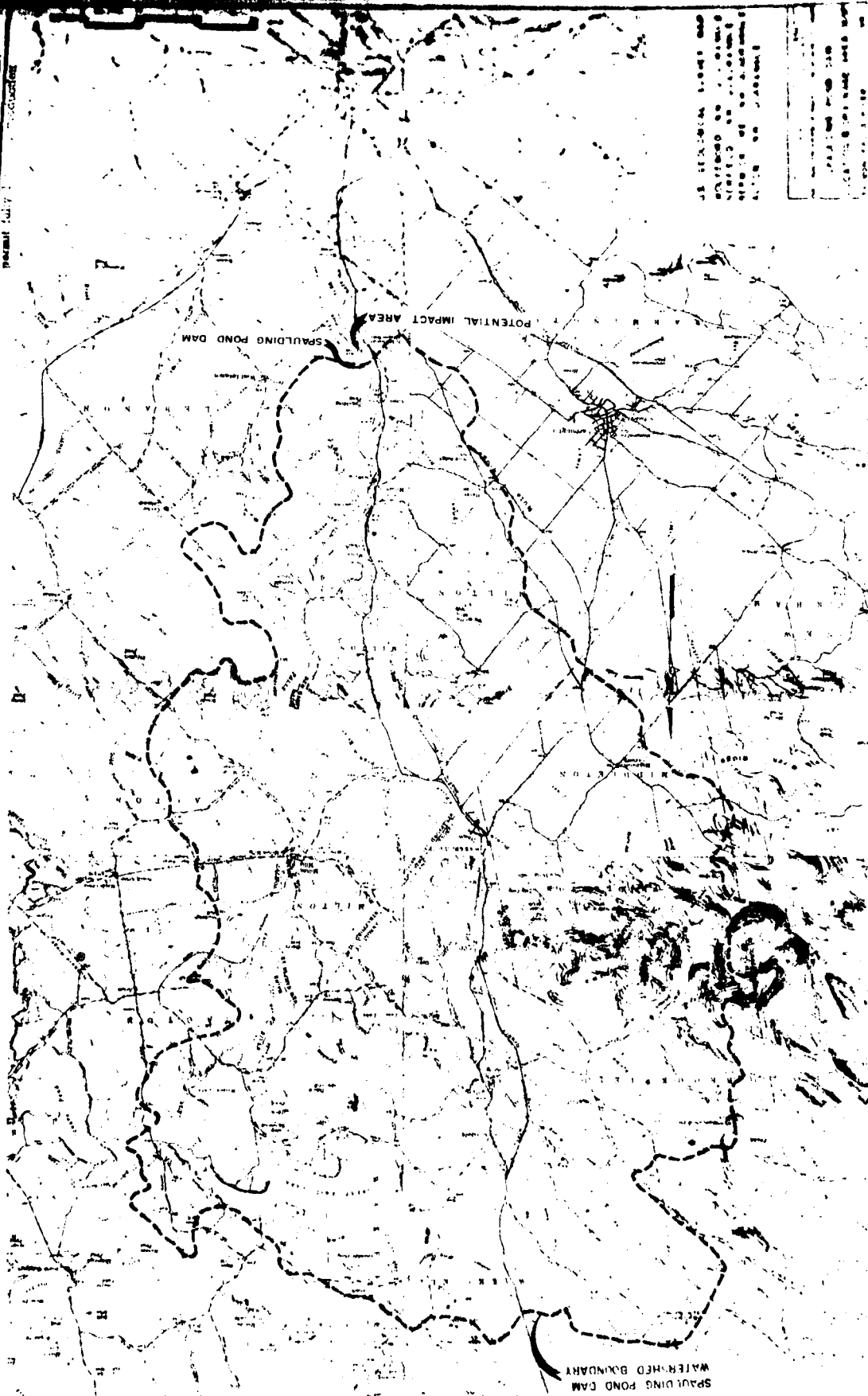


OVERVIEW

●

RECEIVED AT THE
LIBRARY OF THE
U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

...



SPAUDING POND DAM
WATERSHED BOUNDARY

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

SPAULDING DAM

SECTION I

PROJECT INFORMATION

1.1 GENERAL

a. Authority. Public Law 92367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Edward C. Jordan Co., Inc. has been retained by the New England Division to inspect and report on selected dams in the states of Maine and New Hampshire. Authorization and notice to proceed were issued to Edward C. Jordan Co., Inc. under a letter of December 1, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW3379C0017 has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) To encourage and prepare the states to initiate effective dam safety programs for non-Federal dams.
- (3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT

a. Location. The Spaulding Dam is located on the Salmon Falls River in the city of Rochester, New Hampshire. N 43°-22.7', W 70°-59.0'.

- b. Description of Dam and Appurtenances. The Spaulding Dam is a stone masonry gravity structure situated between earth embankment dikes. It is located in a broad, flat section of the Salmon Falls River valley. The dam is approximately 30 feet in height. The masonry structure length is about 157 feet. The masonry section of the dam appears to be founded on bedrock.

Along the southerly embankment of the dam is a canal which carries water to a powerhouse attached to the Spaulding Fibre Company manufacturing plant. Flow to the mill's powerhouse is controlled by three mechanically operated lift gates. Water discharges from the powerhouse to an outlet channel which rejoins the Salmon Falls River about 1,100 feet below the plant.

Descriptive plan, profile, and cross-section sketches of the dam are presented in Appendix B. Photographs of the structure are included in Appendix C.

- c. Size Classification. The Spaulding Pond Dam has a storage capacity of about 700-acre feet and a height of 30 feet. According to the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams," a dam with storage capacity less than 1000-acre feet and height less than 40 feet is classified as a small dam.
- d. Hazard Classification. The dam is classified as having a significant hazard potential. Failure would most likely occur at the dike above the inlet to the mill. The flow from failure would cause damage at the mill buildings. In addition, there are two residences which could be damaged. The residences are located about 1,850 feet below the dam just north of a bridge crossing the Salmon Falls River.

- e. Ownership.

Current Owner: Spaulding Fibre Company
Spaulding Avenue
North Rochester, New Hampshire
03867

Previous Owners: None

f. Operator.

George Davis, Plant Engineer
Spaulding Fibre Company
Tel: 1-603-332-0940

g. Purpose of Dam. This dam provides storage for supplemental hydroelectric power generation at the Spaulding Fibre Company plant at the damsite.

h. Design and Construction History. According to correspondence on file with the New Hampshire Water Resources Board in Concord, New Hampshire, the dam was built about 1899 by J. Spaulding and Sons Co. (now Spaulding Fibre Company). A plan on file with the Sanders Construction Corporation of Portland, Maine indicates that the dam was originally a stone masonry and timber structure designed by I.W. Jones, Engineer. At unrecorded dates between 1899 and 1954, a concrete sill was placed at the toe of the spillway and a concrete buttress wall was added to a portion of the downstream spillway face. In 1954, the dam underwent a major renovation following flood damage. The reconstruction was apparently designed and executed by the Sanders Construction Corporation. This work included a new concrete spillway approach apron and crest, new concrete piers for stop logs and gates, and a new service bridge. New stop logs and gates were also apparently provided at that time, together with manual lift mechanisms for two of the gates and an electrical/mechanical mechanism for the third gate.

Modifications that have been made since the 1954 reconstruction include new headgates at the powerhouse and removal of the service bridge from over the northerly three stop log bays.

i. Normal Operating Procedure. No written operating procedures for the dam were available. The dam is usually operated for power generation. Generating equipment was being used at the time of the visual inspection. The reservoir level is reportedly monitored by designated personnel around-the-clock at a gauge located within the Spaulding Fibre Company plant. An electrical/mechanical gate situated in the south end of the spillway is operated from the powerhouse to maintain appropriate water levels for power generation. According to Spaulding Co. personnel, during periods of high flow, two hand-operated gates are adjusted or stop logs are removed as required. The

New Hampshire Water Resources Board operates the Milton Three Ponds Dam upstream and notifies the Spaulding Company of operating procedures being performed at that dam.

Periodic visual checks are made of the dam throughout the year. Frequency of these checks reportedly varies from about twice weekly in the summer to about once a month in the winter.

1.3 PERTINENT DATA

- a. Drainage Areas. The drainage area above the Spaulding Dam is approximately 118 square miles. The terrain is primarily forested, with some urbanized area, and is generally flat to moderate in slope. Flow at this dam is highly regulated by the Milton Three Ponds Dam which has a drainage area of 108 square miles.
- b. Discharge at Damsite. The spillway consists of twelve individual discharge bays. Three of these are gated. The remaining nine are provided with stop logs. Six of the stop log bays are accessible with hoisting equipment for stop log removal. The following discharges are estimated assuming the water surface is at the top of dam (elev. 250.3 feet).
- (1) Pond drain outlet - 700 cfs.
 - (2) Service outlet to mill - 200 cfs
 - (3) Spillway capacity (with top of stop logs at field inspection, elev.) - 3,700 cfs.
 - (4) Spillway capacity (with stop logs removed from 6 bays and 3 timber gates open) 8,100 cfs.
 - (5) Maximum flood discharge at dam is unknown. However, there was a gauging station on the Salmon Falls River at South Lebanon, Maine (drainage area of 147 square miles) at which the March, 1936 flood was recorded at a peak flow of 5,490 cfs.
 - (6) Total project discharge at test flood (1/2 PMF) - 20,700 cfs at elevation 254 feet (MSL).
- c. Elevation. The following is a table of pertinent elevations at the damsite. Elevations obtained during inspection were based on an arbitrary local datum. Approxi-

mate mean sea level elevations were obtained from the Berwick, Maine-New Hampshire quadrangle (USGS) which indicates a normal water surface elevation of 247 feet.

ITEM	APPROXIMATE ELEVATION ABOVE MSL
Streambed at centerline of dam	220 +
Maximum tailwater	Unknown
Invert of pond drain outlet	227.3
Invert of service outlet to mill	Not Accessible
Normal pool	247.0
Full flood control pool	Not Applicable
Spillway crest	242.0
Design surcharge	Unknown
Top of dam (top of stone masonry at south abutment)	250.3
Top of embankment sections	Varies 250 to 252+
Test flood elevation (1/2 PMF)	254.0

d. Reservoir.

ITEM	LENGTH (MILES)
Normal water surface	1.0
Top of dam	1.1

e. Storage.

ITEM	STORAGE (ACRE-FEET)
Normal pool	325
Top of dam	700
1/2 PMF pool	1,200

f. Reservoir Surface.

ITEM	SURFACE AREA (ACRES)
Normal pool	112
Top of dam	135
1/2 PMF pool	165

g. Dam.

Type - stone masonry with stop log and lift gate controlled spillway structure situated between earth embankment dikes.

Length - Approximately 2,100 feet from powerhouse to end of masonry core wall north of spillway structure. (See site plan in Appendix B-1.)

Height - Approximately 30 feet from top of south abutment to streambed at centerline of dam.

Top Width - See plan and cross-sections in Appendix B-1.

Side Slopes - See plan and cross-sections in Appendix B-1.

Zoning - Unknown.

Impervious Core - Stone masonry core wall extends approximately 90 feet beyond north end of spillway; two concrete walls at low points in south section of embankment; other core provisions unknown.

Cutoff - Masonry placed on bedrock; stone fill placed on upstream side of dam is faced with reinforced concrete slab poured to bedrock at toe.

Grout Curtain - Not known.

h. Diversion and Regulating Tunnel. Not applicable.

i. Spillway

Type - Broad crested weir formed by stone masonry gravity structure with stone fill and sloped concrete face on upstream side, controlled with nine bays of stop logs and three vertical lift gates.

Length - 157 feet between abutments.

Crest Elevation - Invert of stop log and lift gate bays approximately 242 feet (MSL).

Gates - The spillway is divided into 12 discharge bays. Three of these are closed with timber gates, two of which are mechanically operated and one of which is electro-mechanically operated from the Spaulding Company plant. The remaining nine bays are controlled by stop logs.

Upstream Channel - The reservoir lies directly upstream of the spillway (see photograph 7) and appears clear and unobstructed. The amount of silting behind the structure could not be determined because of water level during visual inspection.

Downstream Channel - The channel bed immediately below the spillway is composed of gravel and cobbles. The banks are forested and the stream channel was moderately cluttered with fallen trees and brush. Extent of stream-bed erosion below spillway could not be determined during inspection because of tailwater level.

j. Regulating Outlets.

- | | | | |
|-----|----------------------|---|-----------------|
| (1) | Inverts - | Pond drain outlet | 227.3 ft. |
| | | Service Outlet to Mill | Not available |
| (2) | Sizes - | Pond drain outlet | 6 ft dia. inlet |
| | | | 6 ft x 6 ft |
| | | | outlet |
| | | Service outlet to mill | 3-6 ft x 7 ft |
| | | | gates |
| (3) | Description - | The pond drain outlet is located south of the spillway structure in the stone masonry abutment. The outlet is furnished with a vertical lift timber gate and a stone masonry discharge channel. The service outlet to the mill is located about 1,500 feet south of the spillway structure. The service outlet is furnished with three vertical lift timber gates and currently supplies water to a 300 kilowatt generator. | |
| (4) | Control Mechanisms - | The pond drain outlet is operated by manual mechanical lift equipment located at the spillway. The pond drain outlet has not been operated in several years and may be inoperable. The service outlet to the mill is operated by manual mechanical lift equipment located at the mill. The service outlet is operable. | |

SECTION 2

ENGINEERING DATA

2.1 DESIGN

The only available design data pertinent to the Spaulding Dam is limited to the drawings referenced in Appendix B.

2.2 CONSTRUCTION

No engineering data is available regarding the original construction of the dam. Drawings of the repair work done in 1954 are available from the Sanders Construction Company.

2.3 OPERATION

A chart is on file at the Spaulding Fibre Company plant engineer's office which relates stream discharge and operating head to horsepower output of the generating unit. No other engineering data pertinent to operation of the dam was available.

2.4 EVALUATION

- a. Availability. Although a complete set of detail design drawings and data are not available, one drawing of the original masonry/timber structure and a few drawings of renovations of the structure are available.
- b. Adequacy. The available drawings are inadequate for an in-depth review of the design and construction of Spaulding Dam. The assessment is therefore based primarily on visual inspection, performance history, and engineering judgment.
- c. Validity. Limited measurements of physical dimensions of the dam were made during the visual inspection. Some differences were noted in comparison with available design drawings. The lack of construction data does not allow for determination of whether differences noted are due to design alterations during construction or other causes.

SECTION 3
VISUAL INSPECTION

3.1 FINDINGS

a. General. The Spaulding Dam is located in a broad, flat section of the Salmon Falls River valley. The dam impounds Spaulding Pond. It is a stone masonry gravity dam, apparently founded on bedrock, situated between earth embankment dikes which are apparently constructed on a natural esker formation. A canal flows from the damsite south to a powerhouse at the Spaulding Fibre Company plant. Additional information describing the configuration of the dam and detailed notes of the visual inspection are included in Appendix A (Visual Inspection Checklist and Supplementary Inspection Notes), Appendix B (plan, profile and cross sections of the structure), and Appendix C (photographs).

b. Dam.

- (1) Structural - The Spaulding Dam consists of a straight drop spillway supported by a stone masonry gravity dam with a concrete cap, sill, and gate piers. Earth embankments are located on either side of the stone masonry structure. The masonry portions of the dam appear to be in good condition, but the concrete elements show evidence of some deterioration. The inspection resulted in the following major findings:
 - (a) The earth embankments of the dam appear to consist of generally granular soils. Sections of these embankments have masonry or concrete core walls. The embankments appear to consist of fill placed in lower sections of a natural esker.
 - (b) The crest of the north embankment and the slopes of both embankments are wooded. Ground cover consists of forest duff and bushes. Substantial erosion has occurred on the upstream face of the south embankment in an area located about 30 feet south of the spillway (see Photo 3). Some erosion was noted on the

downstream slope of the north embankment at the abutment to the dam. Tree roots have grown across the surface of the masonry core wall on the north embankment (see Photo 5).

- (c) Portions of the south embankment appear to have very little freeboard. One area located at the canal entrance and a second area between the canal and spillway are furnished with concrete core walls and are at least one foot lower than the general embankment grade (see Photo 4). A third area immediately above the powerhouse headworks appears to be about two feet lower than the general grade of the earth embankment. The embankment lacks erosion-resistant vegetative cover.
- (d) A large spring exists in the edge of the stream bank below the north abutment (see Photo 6). The flow from this spring was estimated to be at least 50 gpm. Erosion and local sloughing of the stream bank have occurred in the area of the spring. Several smaller springs were also observed along the north stream bank downstream of this area.
- (e) The masonry elements of the dam appear to be in good condition and true to line and grade. The mortar joints in the masonry are generally in good condition. Some joints in the lower portions of the spillway training walls and downstream face of the spillway have eroded slightly.
- (f) The concrete sill below the spillway has spalled and eroded substantially (see Photo 2). The spillway cap and the stop log and gate piers have spalled and eroded slightly, but are in generally good condition.
- (g) Some minor leakage is occurring through the downstream face of the masonry (see Photo 2). Several drains are located in this face, but no flow was observed from the drains.
- (h) A portion of the masonry in the downstream face of the spillway has been encased by a concrete wall and two buttresses.

(2) Hydraulics - At the time of visual inspection, the pond level was estimated to be at elev. 246.2 feet (MSL). About 0.2 feet of water was passing over the northern nine bays of the spillway. Water was also being discharged through the powerhouse at the Spaulding Fibre Company plant. The low level outlet gate was not operated during the inspection and has reportedly not been operated for a number of years. The upstream and downstream channels appeared relatively clear and unobstructed (see Photos 7 and 8).

c. Appurtenant Structures. The spillway is controlled by nine sets of stop logs and three vertical lift gates. Six sets of the stop logs can be removed by a hoist from the service bridge. Three sets cannot be removed since the service bridge has been removed from over these bays. The stop logs and slots appear to be in good condition. The gates appear to be in good condition as is the hoisting equipment. A pond drain outlet with a vertical lift gate is located at the south end of the spillway structure and appears to be in fair condition. The hoisting equipment for the pond drain outlet appears to be in good condition, except for the lifting stems which are rotted and could potentially fail during operation of the gate. The service outlet works at the end of the canal at the Spaulding Fibre Company plant consist of three 6 foot by 7 foot gates and appear to be in good condition.

d. Reservoir Area. The reservoir consists of a pond of about 112 acres which has a forested shoreline (see Photo 7). No residences were observed on the shores of the pond. The potential for slope failure upstream from the dam appears minimal.

e. Downstream Channel. The river bed immediately below the dam (see Photographs 6 and 8) is composed of gravel and cobbles. The discharge channel downstream of the mill powerhouse is composed of sand, silt and gravel. The powerhouse discharge channel joins the Salmon Falls River channel about 1,100 feet downstream of the mill. The banks of both channels are forested (see Photographs 10 and 11). The river channel was cluttered with some small fallen trees and brush, as shown in Photograph 8. The canal channel was essentially clear of debris and unobstructed.

3.2 EVALUATION

Based on the visual inspection, the Spaulding Dam appears to be in good condition. The facility has apparently been well maintained. The southerly earth embankment appears to have little freeboard and to be highly susceptible to erosion should overtopping flow occur. The concrete sill and stop log piers are eroded and spalled and require maintenance. As outlined in Section 7, rehabilitative construction and maintenance should be performed to assure the long-term safety of the structure.

SECTION 4

OPERATING PROCEDURES

4.1 PROCEDURES

No written operating procedures for the dam were available. The dam is operated for power generation, and generating equipment was being used at the time of the visual inspection. The reservoir level is reportedly monitored by designated personnel around-the-clock at a gauge located within the Spaulding Fibre Company plant. An electrical/mechanical gate situated in the south end of the spillway is operated from the powerhouse to maintain appropriate water levels for power generation. During periods of high flow, two hand operated gates are adjusted or stop logs are removed as required. The New Hampshire Water Resources Board operates the Milton Three Ponds Dam upstream and notifies the Spaulding Company of operating procedures being employed at that dam.

Periodic visual checks are made of the dam throughout the year. Frequency of these checks reportedly varies from about twice weekly in the summer to about once a month in the winter.

4.2 MAINTENANCE OF DAM

Maintenance of the dam is on an as-needed basis. The dam is maintained in good condition. Frequent checks of the facility are reportedly made by Spaulding Fibre Company personnel to detect vandalism or deterioration and to make necessary repairs.

4.3 MAINTENANCE OF OPERATING FACILITIES

Stop logs and spillway gates appear to be in good repair. All hoisting equipment appears operable and in good condition, except the timber lift members of the controlled outlet mechanism which show signs of some rot. Maintenance of the equipment is on an as-needed basis.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

As noted above, the New Hampshire Water Resources Board notifies the Spaulding Fibre Company of significant operational measures performed at the Milton Three Ponds Dam

located upstream. Other than this informal system, no warning system is known to be in effect.

4.5 EVALUATION

The Spaulding Dam is apparently kept in generally good repair. Periodic checks are made of the structure to detect items in need of repair and to curb vandalism. No formal flood warning system is in effect at the dam, however, water levels are reportedly monitored 24 hours a day at the Spaulding Fibre Company plant.

SECTION 5
HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

- a. General. The Spaulding Dam is a stone masonry gravity dam with earth embankments on either side of the dam. It is located in a broad, flat section of the Salmon Falls River valley. The dam impounds Spaulding Pond, which has a maximum storage capacity of about 700 acre-feet. The discharge of the Salmon Falls River is regulated by Milton Three Ponds Dam which is located approximately 3 miles upstream of the Spaulding Dam.
- b. Design Data. Hydraulic and hydrologic design data were not available.
- c. Experience Data. The U.S. Geological Survey maintains a gauge just below Milton Three Ponds Dam (drainage area of 108 square miles). The gauge was established in 1968. The maximum discharge recorded at the gauge to date is 3,500 cfs, occurring on March 15, 1977. During a flood event in March, 1936, a discharge of 5,490 cfs was recorded on the Salmon Falls River at South Lebanon, Maine (drainage area of 147 square miles). During May, 1954, a discharge of 4,940 cfs was recorded at the South Lebanon gauge. Though water levels at the dam are continuously monitored, no records are kept, and the water surface elevations resulting from these flood events are unknown.
- d. Visual Inspection. Flow is controlled at the Spaulding Pond Dam by three vertical lift gates and nine stop log bays. Of the nine stop log bays, six are accessible from the service bridge. The remaining three bays are accessible only by boat. During the visual inspection, the depth of flow was about 0.2 feet over the stop logs which were at elevation 246 feet.
- e. Test Flood Analysis. The Spaulding Dam is classified as a small-size dam with a significant hazard potential. Using Corps of Engineers' Guidelines for Phase I Inspections as outlined in the "Recommended Guidelines for Safety Inspection of Dams," the test flood for this dam is one-half of the Probable Maximum Flood (PMF).

The peak discharge of the 1/2 PMF at Spaulding Dam was computed to be 20,700 cfs (see Appendix D for calculations). Flow at Spaulding Dam is regulated by the Milton Three Ponds Dam, which has a drainage area of about 108 square miles. According to a Phase I Inspection Report dated August, 1978, the 1/2 PMF outflow from Milton Three Ponds Dam is 17,500 cfs. Between the Milton Three Ponds Dam and the Spaulding Dam are the Milton Leather Board Dam and two much smaller dams, none of which would significantly reduce the 1/2 PMF flow due to routing effects. The intervening drainage area between Milton Three Ponds Dam and Spaulding Dam is about 10 square miles. Based on the COE Recommended Guidelines, the 1/2 PMF inflow for this area is 3,500 cfs. Therefore, the 1/2 PMF inflow at Spaulding Dam is 21,000 cfs. Accounting for the effects of surcharge storage, the 1/2 PMF outflow at Spaulding Dam is 20,700 cfs.

The total spillway discharge capacity at the top of the dam is about 8,300 cfs with the three gates open and the stop logs removed from six of the nine stop log bays. This capacity is 40% of the test flood (1/2 PMF). With stop logs removed, the test flood would overtop the dam by about 4 feet. With stop logs in place and gates closed as they were during the visual inspection, spillway capacity is about 3,900 cfs, or 19% of the test flood.

- f. Dam Failure Analysis. The hazard potential was determined by analyzing downstream dam failure hydrographs according to rule of thumb methods as described in an attachment to ETL 1100-2-234. The failure analysis assumes a breaching of the dam when the reservoir water surface elevation is level with the top of the dam. It was concluded that the most likely location for a breaching of the dam to take place would be at the end of the canal near the service outlet to the mill.

The flood peak from the breaching plus the discharge from the dam occurring when the water surface is at the top of the dam is 13,200 cfs. The time required to empty the reservoir would be about 1.25 hours. At the first downstream bridge, located about 1,850 feet downstream of the dam, the peak flow would be reduced to about 10,300 cfs with flooding 3 feet above the bridge deck. Downstream of the bridge the flood plain gradually broadens, and valley storage capacity increases. Thus

damage downstream of that bridge would probably be minimal.

The dam is classified as having a significant hazard potential because there are two residences located below the first downstream bridge which might be damaged should failure occur. The Spaulding Fibre Company plant is not in direct line of the hypothetical failure wave, although the mill buildings would likely sustain some damage from the high water at the time of failure.

The masonry section of the dam is apparently founded on bedrock, and should be resistant to significant damage from overtopping. The earth embankment portions of the dam are apparently constructed on a natural esker formation. These embankments are not resistant to erosion due to overtopping, even for short periods.

SECTION 6
STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

- a. Visual Observations. Based on the visual observations, the Spaulding Dam appears to be in good condition. The stone masonry and concrete elements of the dam appear true to line and grade and show no evidence of serious distress. Some erosion and spalling of the concrete has occurred but has not progressed to a point where structural distress would be likely.

The earth embankment wingwalls appear to consist of granular soils. No serious seepage is apparent. The embankments are wooded and ground cover consists of forest duff and bushes. The embankments appear to be susceptible to erosion if overtopped. The south embankment has three areas where the crest is 1 to 2 feet lower than the general crest elevation. These areas are more susceptible to overtopping and erosion and are therefore of concern. Erosion was noted on the downstream side of the north embankment adjacent to the spillway structure and at the upstream side of the south embankment at the spillway structure.

- b. Design and Construction Data. The masonry section of the dam was originally designed by I.W. Jones, Engineer, as a stone masonry gravity dam with a timber upstream apron and timber and steel stop log system at the spillway crest. A drawing of this original design is referenced in Appendix B. Based on this drawing, it appears that this portion of the dam was to be founded on bedrock. No data concerning original embankment design were available and no data concerning original construction was disclosed in this investigation.
- c. Operating Records. No operating records were available for this investigation.
- d. Post-Construction Changes. At unrecorded dates between original construction in 1899 and 1954, a concrete sill was placed at the toe of the spillway and a buttress wall was added to a portion of the downstream face of the spillway. In 1954, a major renovation was under-

taken. Drawings of this reconstruction are referenced in Appendix B. This reconstruction consisted of replacing the upstream timber apron with concrete and the installation of concrete stop log piers and new stop logs, new spillway gate lifts, and the service bridge. The only other changes known to have been made are the subsequent removal of a section of the service bridge over the northerly three stop log bays and the placement of grouted riprap on the north upstream embankment.

- e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines, does not warrant seismic analyses.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

- a. Condition. The visual inspection indicates that the Spaulding Dam is in fair condition. Major concerns relative to the physical condition of the dam are the potential overtopping and erosion of low areas in the earth embankments, and the inability to remove stop logs in the northerly three bays.
- b. Adequacy of Information. The information available is such that the assessment of the condition of the dam must be based primarily on the visual inspection, the past operational performance of the dam, and engineering judgment.
- c. Urgency. The recommendations outlined in Sections 7.2 below should be implemented within 24 months after receipt of this report by the owner. The remedial measures outlined in Section 7.3 should be implemented within 12 months after receipt of this report by the owner.
- d. Need for Additional Investigation. Additional investigation is not considered necessary for the current assessment.

7.2 RECOMMENDATIONS

The embankment portions of the dam should be repaired where eroded, raised to a uniform elevation with appropriate materials, and riprapped and/or turfed with an erosion resistant vegetative cover. A program of complete or selective cutting of trees from the embankments and preservation of stumps with subsequent monitoring for deterioration should be investigated and implemented. This embankment repair should be done under the supervision of a qualified engineer.

A qualified engineer should be engaged to further evaluate the hydrology of the watershed and hydraulics of the dam. This study should evaluate the need for increased spillway capacity, and its findings should be implemented.

7.3 REMEDIAL MEASURES

The following remedial measures should be implemented within 12 months.

a. Operating and Maintenance Procedures. The program of regular inspection and maintenance of the dam should be continued and a record of these activities should be kept. The following specific maintenance and operating procedures should be implemented:

- (1) The service bridge and crane rails should be reinstalled over the northerly three stop log bays to allow removal of stop logs from this spillway section.
- (2) The spalling of the concrete surfaces in the dam should be repaired.
- (3) The spring downstream of the north abutment of the spillway should be monitored. Remedial actions should be taken if the flow volumes increase or piping of soil from the spring is noted.
- (4) Deteriorated timber lifting stems of the controlled outlet gate hoist should be repaired or replaced.
- (5) Around-the-clock surveillance of the structure during periods of anticipated high runoff should be provided.
- (6) A formal warning system should be developed and implemented in the event of an emergency.
- (7) Inspections of the dam should be made by qualified engineers once every two years.

7.4 ALTERNATIVES

Not applicable.

APPENDIX A

VISUAL INSPECTION CHECKLIST
AND
SUPPLEMENTARY INSPECTION NOTES

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Spaulding Dam

DATE 11/14/78

TIME A.M.

WEATHER Sunny, cool

W.S. ELEV. 246.2+ U.S. 227.2+ DN.S.

PARTY:

1. <u>Stephen Cole</u>	6. <u>John Kimble</u>
2. <u>Brian Bisson</u>	7. <u></u>
3. <u>David Nyman</u>	8. <u></u>
4. <u>John Devine</u>	9. <u></u>
5. <u>Timothy Noonan</u>	10. <u></u>

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Geotechnical</u>	<u>Cole</u>	
2. <u>Hydraulics/Hydrology</u>	<u>Bisson, Devine</u>	
3. <u>Civil</u>	<u>Nyman</u>	
4. <u>Structural</u>	<u>Cole, Devine, Nyman</u>	
5. <u>Survey</u>	<u>Noonan, Kimble</u>	
6. <u>Photographs</u>	<u>Nyman, Bisson</u>	

Review Inspection - 12/1/78 S. Walker, C. Horstmann

No significantly different conditions were observed.

NOTE: See Supplementary Inspection Notes Following Checklist

INSPECTION CHECKLIST

PROJECT Spaulding Dam DATE 11/14/78
 PROJECT FEATURE Dike Embankment NAME Cole
 DISCIPLINE Geotechnical NAME _____

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	250 to 252+ (MSL)
Current Pool Elevation	246.2+ (MSL)
Maximum Impoundment to Date	Unknown - no overtopping apparent
Surface Cracks	None
Pavement Condition	Gravel, turf
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Varies, some areas appear low
Horizontal Alignment	Okay
Condition at Abutment and at Concrete Structures	Appears good, joints to concrete good. Repair has been made at north abutment. Some erosion behind north wingwall.
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	None, no animal burrows. Tree and brush growth on slopes.
Sloughing or Erosion of Slopes or Abutments	Erosion on upstream slope of south dike.
Vegetation	Trees and brush

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u> (cont.)	
Rock Slope Protection - Riprap Failures	Generally no riprap
Unusual Embankment or Downstream Seepage	Large spring near toe of dike at edge of downstream channel, north embankment.
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

INSPECTION CHECKLIST

PROJECT Spaulding Dam DATE 11/14/78
 PROJECT FEATURE Intake Channel, Structure NAME Cole, Nyman
 DISCIPLINE Structural, Geotechnical NAME Bisson, Devine
Hydrology/Hydraulics

AREA EVALUATED	CONDITION
----------------	-----------

OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE

a. Approach Channel

Slope Conditions

Some erosion of embankment slope south of spillway.

Bottom Conditions

Clear, unobstructed at both service outlet to mill and pond drain outlet.

Rock Slides or Falls

None

Log Boom

None

Debris

None

Condition of Concrete Lining

None

Drains or Weep Holes

None

b. Intake Structure

Condition of Stone Masonry

Good condition, cut stone

Stop Logs and Slots

None

INSPECTION CHECKLIST

PROJECT Spaulding Dam DATE 11/14/78
 PROJECT FEATURE Control Tower NAME Cole, Nyman
 DISCIPLINE Structural, Geotechnical NAME Bisson, Devine
Hydrology/Hydraulics

AREA EVALUATED	CONDITION
----------------	-----------

OUTLET WORKS - CONTROL TOWER

a. Masonry and Structural

General Condition	Fair to good
Condition of Joints	Good
Spalling	N/A
Visible Reinforcing	N/A
Rusting or Staining of Concrete	N/A
Any Seepage or Efflorescence	Some seepage through masonry in the roof of the discharge channel of pond drain outlet.
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None
Cracks	None
Rusting or Corrosion of Steel	None

b. Mechanical and Electrical

Air Vents	N/A
Float Wells	N/A
Gate Hoist	Manual gate hoists condition okay
Elevator	None

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - CONTROL TOWER (cont.)</u>	
Hydraulic System	None
Service Gates	Outlet to mill, vertical lift timbers, fair to good.
Emergency Gates	Pond drain, vertical lift gate, some timbers rotting, may be inoperable.
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System	None

INSPECTION CHECKLIST

PROJECT Spaulding Dam DATE 11/14/78
 PROJECT FEATURE Transition, conduit NAME Cole, Nyman
 DISCIPLINE Structural, Geotechnical NAME Bisson, Devine
Hydraulics/Hydrology

AREA EVALUATED	CONDITION
----------------	-----------

OUTLET WORKS - TRANSITION AND CONDUIT

General Condition of Stone Masonry	Good
Rust or Staining on Stone Masonry	None
Spalling	N/A
Erosion or Cavitation	None
Cracking	None
Alignment of Monoliths	N/A
Alignment of Joints	Good
Numbering of Monoliths	N/A

PERIODIC INSPECTION CHECKLIST

PROJECT Spaulding Dam DATE 11/14/78
 PROJECT FEATURE Outlet Structure/Channel NAME Cole, Nyman
 DISCIPLINE Structural, Geotechnical NAME Bisson, Devine
Hydrology/Hydraulics

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Masonry	Good
Rust or Staining	None
Spalling	N/A
Erosion or Cavitation	None
Visible Reinforcing	N/A
Any Seepage or Efflorescence	Some seepage through joints in masonry at roof of pond drain discharge channel
Condition at Joints	Good
Drain holes	None
Channel	
Loose Rock or Trees Overhanging Channel	Some trees in channel of pond drain outlet. Discharge channel of service outlet was clear.
Condition of Discharge Channels	Appears good

INSPECTION CHECKLIST

PROJECT Spaulding Dam DATE 11/14/78
 PROJECT FEATURE Spillway NAME Cole, Nyman
 DISCIPLINE Geotechnical, Structural NAME Bisson, Devine
Hydrology/Hydraulics

AREA EVALUATED	CONDITION
----------------	-----------

OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS

a. Approach Channel

General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Appears clear, unobstructed

b. Weir and Training Walls

General Condition of Concrete and Masonry	Fair, stop log piers spalled
Rust or Staining	None
Spalling	Stop logs piers spalled, and sill at toe is badly spalled.
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None
Drain Holes	Drains in lower part of down-stream face, no flow noted.

c. Discharge Channel

General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some trees in channel
Floor of Channel	Bedrock and boulders, no apparent scour.
Other Obstructions	None

SUPPLEMENTARY INSPECTION NOTES
SPAULDING DAM
ROCHESTER, NEW HAMPSHIRE

1. CONCRETE STRUCTURES IN GENERAL

- a. Concrete Surfaces. The concrete portions of the dam consist of a sill below the spillway, a portion of the spillway face, the spillway crest between the gates, and stop log piers. The piers and the spillway crest are in generally good condition with little spalling evident. One pier has spalled somewhat more seriously around a crack near the downstream face. The concrete on the downstream face of the dam appears to be in good condition. The sill below the spillway is in poor condition, with serious spalling on much of its length. Loose aggregate was also noted on this sill.

Stone Masonry Surfaces. Stone masonry portions of the dam are generally cut granite laid in mortar. The masonry appears true to line and grade. The mortar is generally intact and in good condition; however, the lower portion of the training walls at the ends of the spillway show evidence of loss of mortar.

- b. Structural Cracking. No evidence was found to indicate structural cracking of the dam.
- c. Movement, Horizontal and Vertical Alignment. The dam appears to be true to line and grade. No settlement or deflection of the structure was observed.
- d. Junctions. The junctions of both north and south embankments to their respective training walls appear to be in good condition. The junctions between the training walls and the spillway are also in good condition. Riprap has been recently placed upstream of the north training wall. This riprap has been grouted, apparently to repair erosion in that area.
- e. Drains. Two-inch diameter drains were noted in the downstream face of the spillway section of the dam, located about one foot above the concrete sill. These drains appear to be open; however, little or no flow was observed to be coming from them.

INSPECTION CHECKLIST

PROJECT Spaulding Dam DATE 11/14/78
 PROJECT FEATURE Service Bridge NAME Cole
 DISCIPLINE Structural NAME Nyman

AREA EVALUATED	CONDITION
----------------	-----------

OUTLET WORKS - SERVICE BRIDGE

a. Superstructure

Bearings	Okay
Anchor Bolts	Okay
Bridge Seat	Good
Longitudinal Members	Good
Under Side of Deck	Good
Secondary Bracing	Okay
Deck	Good
Drainage System	None
Railings	Good
Expansion Joints	None
Paint	Good

b. Abutment & Piers

General Condition of Concrete	Fair, some spalling
Alignment of Abutment	Good
Approach to Bridge	Okay
Condition of Seat & Backwall	Okay

NOTE: Service bridge deck and beams removed from three spans at north end.

- f. Water Passages. The concrete and stone masonry surfaces making up the training walls and the crest of the spillway were found to be in good condition with no erosion or cavitation evident. The sill below the spillway shows signs of erosion and spalling of concrete.
- g. Seepage or Leakage. Some leakage was observed through the downstream face of the spillway through the stone masonry, adjacent to the pond drain outlet. This leakage appears to be coming through the stone masonry from the reservoir.
- h. Monolith Joints. The concrete sill below the spillway appears to have been placed in three lifts. The lower lift appears to be in very good condition with little spalling evident. The second lift, about three feet in thickness, shows signs of serious deterioration. The top lift, approximately eighteen inches thick shows signs of some erosion or wear. Joints between the lifts appear to be tight.
- i. Foundation. The dam appears to be founded on bedrock. The foundation could not be inspected in detail due to water levels both upstream and downstream. No settlement was observed, indicating little or no foundation distress. No undermining of the toe of the dam was observed.
- j. Abutments. The abutments of the masonry section of the dam are the training walls at each end of the spillway. The training walls appear to be in good condition and are true to line and grade.

2. EMBANKMENT STRUCTURES

- a. Settlement. The embankment areas show no evidence of localized or overall settlement.
- b. Slope Stability. The embankments appear to be constructed of sand or gravel, but in some areas appear to be portions of a natural esker. The slopes are generally 2-to-1 but in some areas are as steep as 1-1/2-to-1 and appear stable. Considerable tree and brush growth exists on the slopes.

- c. Seepage. A large iron spring exists downstream of the north abutment. There appear to be several small springs in this area. The largest of the springs has caused some erosion of the downstream slope at the edge of the stream. No soil material was observed to be piping from the spring. Along the south earth dike some seepage was evidenced at the toe in the form of wet areas, but no distinct springs were observed. The embankment sections of the dam are tree and brush covered. No animal burrows were observed.
- d. Drainage Systems. No drainage system is known to exist in the earth embankment portions of the dam. None was observed.
- e. Slope Protection. The upstream face of the north embankment generally is not riprap covered, but the portion immediately north of the spillway training wall has been riprapped and the riprap has been grouted. No slope protection exists downstream of the dam on either the north or south bank. Some erosion or sloughing of the downstream slope of the north embankment has occurred next to the spillway wingwall. The upstream face of the south embankment has no riprap slope protection and an area of substantial erosion exists approximately thirty feet south of the spillway wingwall. Portions of the south embankment have very little freeboard. One area located at the service outlet entrance to the mill and a second area located along the supply canal have elevations about 1 to 2 feet lower than the general grade of the earth embankment.

3. SPILLWAY STRUCTURES

The spillway consists of stop logs between concrete piers and three spillway gates.

- a. Control Gates and Operating Machinery. The spillway control consists of nine sets of stop logs which are operated by an overhead crane which travels the length of the service bridge. The three sets of stop logs at the north end of the dam can not be removed by this crane, as the service bridge has been removed from this section. Three timber vertical lift gates exist near the south end of the dam. Two of these are manually operated, while the third one is electro-mechanically operated. The gates, stop logs and hoisting equipment appear to be in good condition.

- b. Unlined Saddle Spillways. Two areas along the south embankment appear to be unlined saddle spillways. These areas each have a concrete wall embedded in the embankment section of the dam, and each is lower than the general elevation of the embankment and would be overtopped prior to general overtopping of the embankment. No erosion was observed downstream of these saddles, however.
- c. Approach and Outlet Channels. The approach and outlet channels of the spillway are clear and unobstructed.
- d. Stilling Basin. The stilling basin below the spillway consists of a horizontal concrete apron and a plunge pool formed over the life of the structure. The amount of scour of the streambed at the downstream toe of the dam could not be determined due to tailwater level.

4. OUTLET WORKS

The pond drain outlet is controlled by a vertical lift timber gate and has a stone masonry discharge channel. The service outlet to the mill consists of three 6 ft by 7 ft vertical lift timber gates controlling flow to the power generation unit. Both outlet works are operated manually through the use of mechanical rack and gear system. The pond drain outlet has not been operated in several years.

- a. Intake Structure. The inlet of the pond drain outlet is located in a stone masonry face. The area appears to be clear and unobstructed. The canal delivering water to the service outlet is also free of debris and obstructions.
- b. Operating and Emergency Control Gates. The pond drain outlet gate is manually operated by a rack and gear system. The gate is a vertical lift type. The hoisting equipment appears to be in good condition, however, the vertical timber stems on the gate appear to be rotted. The service outlet to the mill is also manually operated by a rack and gear system and appears to be in good working condition.
- c. Conduits, Sluices and Water Passages. The interior surfaces of the pond drain outlet sluiceway were found to consist of cut granite stone with mortared joints. The surfaces of this outlet were found to be in very good condition. The interior flow channel to the power generating unit could not be inspected.

- d. Stilling Basin. The stilling basin downstream of the pond drain outlet consists of a plunge pool. The amount of erosion in this channel could not be determined due to tailwater elevations. The stilling basin below the power generating unit consisted of a small after-bay.
- e. Approach and Outlet Channels. The approach and outlet channels to the outlet appear to be clear and unobstructed.
- f. Drawdown Facilities. Drawdown facilities consist of the pond drain outlet at the dam and the service outlet to the mill at the south end of the earth embankment. The pond drain outlet was not operated, but if operable, it appears to be sufficient to drain the reservoir during low river flow conditions. The service outlet is operable.

5. SAFETY AND PERFORMANCE INSTRUMENTATION

None.

6. RESERVOIR

- a. Shoreline. No major active or inactive landslide areas on Spaulding Pond were observed.
- b. Sedimentation. The extent of sedimentation in the pond could not be observed during the visual inspection, but it does not appear to impede flow to the spillway or outlet works. Upstream reservoirs, particularly Milton Three Ponds, likely provide for some settling of sediment.
- c. Potential Upstream Hazard Area. No significant upstream hazard was observed.
- d. Watershed Runoff Potential. The watershed is essentially rural with flat to mildly sloping terrain.

7. DOWNSTREAM CHANNEL

The river channel immediately below the dam is composed of gravel and cobbles and is shown in Photographs 6 and 8. The outlet channel downstream of the mill powerhouse is composed of sand, silt and gravel. This channel joins the Salmon Falls River about 1,100 feet downstream of the mill. The banks of both channels are forested as shown in Photographs 10 and 11. The outlet channel below the powerhouse is clear

of debris and unobstructed. The river channel below the spillway is moderately obstructed with fallen trees and brush.

8. OPERATION AND MAINTENANCE FEATURES

The dam appears to be generally well maintained. The pond drain outlet gate at the main dam appears to need maintenance since its vertical stems are rotted. The service bridge has been recently repaired and was found to be in good condition.

APPENDIX B
ENGINEERING DATA

This appendix lists the engineering data collected from project records and other sources of data developed as a result of the visual inspection. The contents of this appendix are listed below.

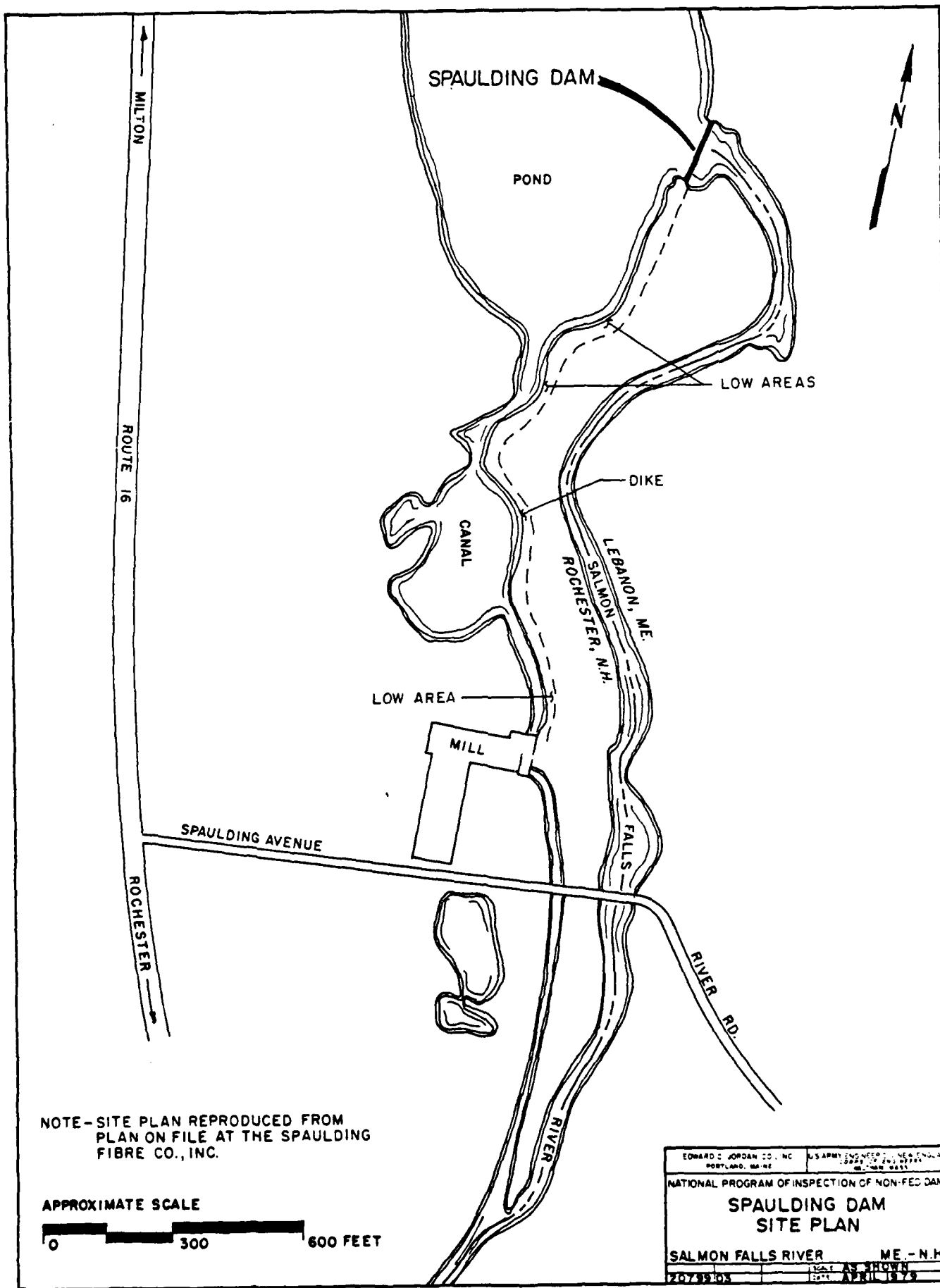
<u>Appendix</u>	<u>Description</u>
B-1	General Project Data
B-2	Past Inspection Reports

APPENDIX B-1

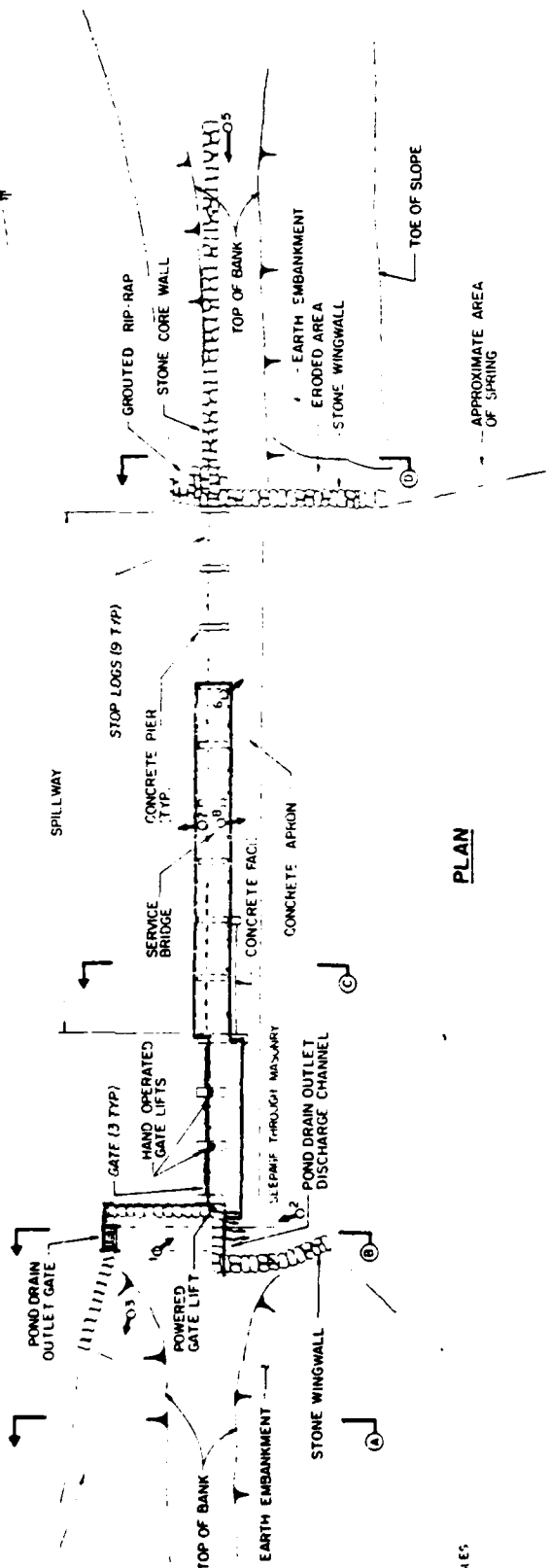
GENERAL PROJECT DATA

- I. The following material relative to the Spaulding Dam is on file at the Spaulding Fibre Company plant in North Rochester, New Hampshire:
 - A. Drawing No. 20-20-L: "Land in Rochester - N.H. & Lebanon - Maine, Spaulding Fibre Co., Inc., North Rochester - New Hampshire," March 1953, by Grant L. Davis, P.E. (This is a site plan of the dam and mill area and is reproduced at reduced scale and included in this Appendix with annotations.)
 - B. Drawing No. 354-03-01: "Gate Piers - Anchor Bolt Layout," 8/3/54, by Sanders Construction Corporation, Portland, Maine.
 - C. Drawing No. 354-03-02: "Repairs to Dam - Details," 7/19/54, by Sanders Construction Corporation.
 - D. Drawing No. 354-03-03 (Rev. 3): "Proposed Repairs to Dam," 5/7/54, by Sanders Construction Corporation.
 - E. Chart of water power data relating generation equipment horsepower to stream flow and operating head.
 - F. Miscellaneous notes relating to dam maintenance, license applications, Piscataqua River Basin data.
- II. In addition to copies of plans identified in I-B, C, & D above, the following plan is on file with the Sanders Construction Corporation in Portland, Maine:
 - A. "Stone and Timber Dam, J. Spaulding & Sons, South Milton, N.H.," (undated), I.W. Jones, Engineer.
- III. The following material is available at the New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire:
 - A. Periodic inspection reports, copies of which are attached as Appendix B-2 of this report.
 - B. Photographs taken at the dam at various times during the period 1935 to present.

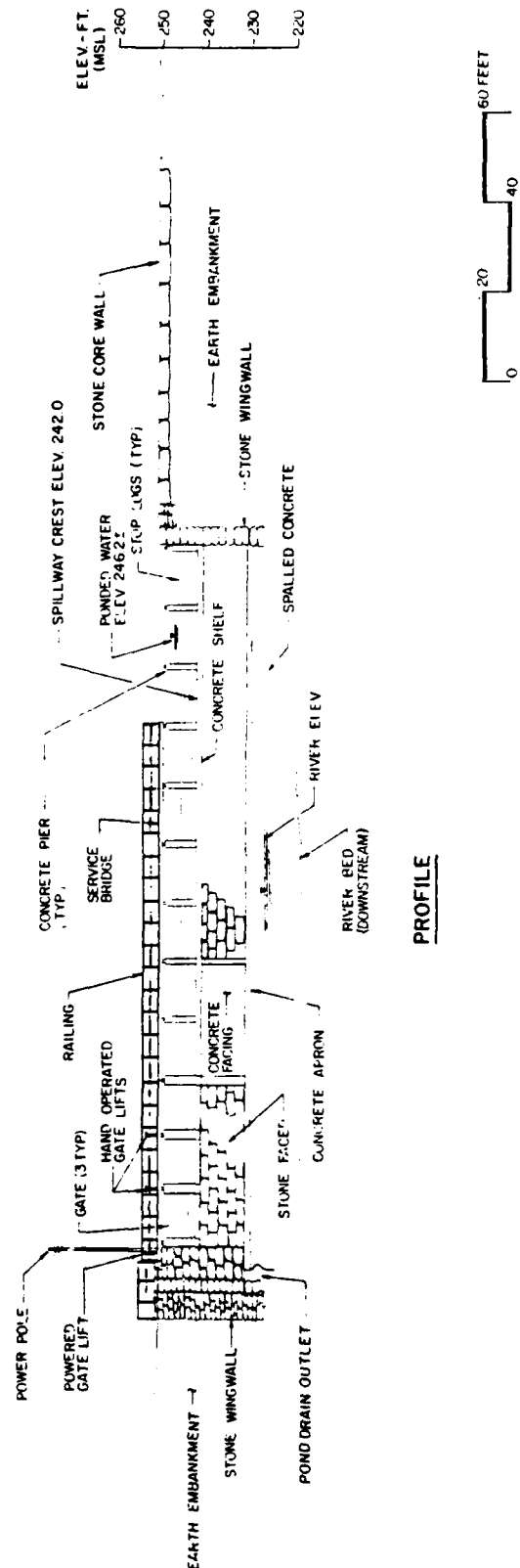
- C. Miscellaneous correspondence and inventory data; also, petition-related material for reconstruction of the dam in 1954.
- IV. The following site plan is a reduced reproduction of the plan cited in I-A above, with annotations added as a result of the visual inspection. Following this plan are sketches of plan, profile, and cross-sections of the dam which were developed from a limited stadia survey performed during visual inspection, taken during inspection. Approximately U.S.G.S. elevations were obtained as described in Section 1.3-c of this report.



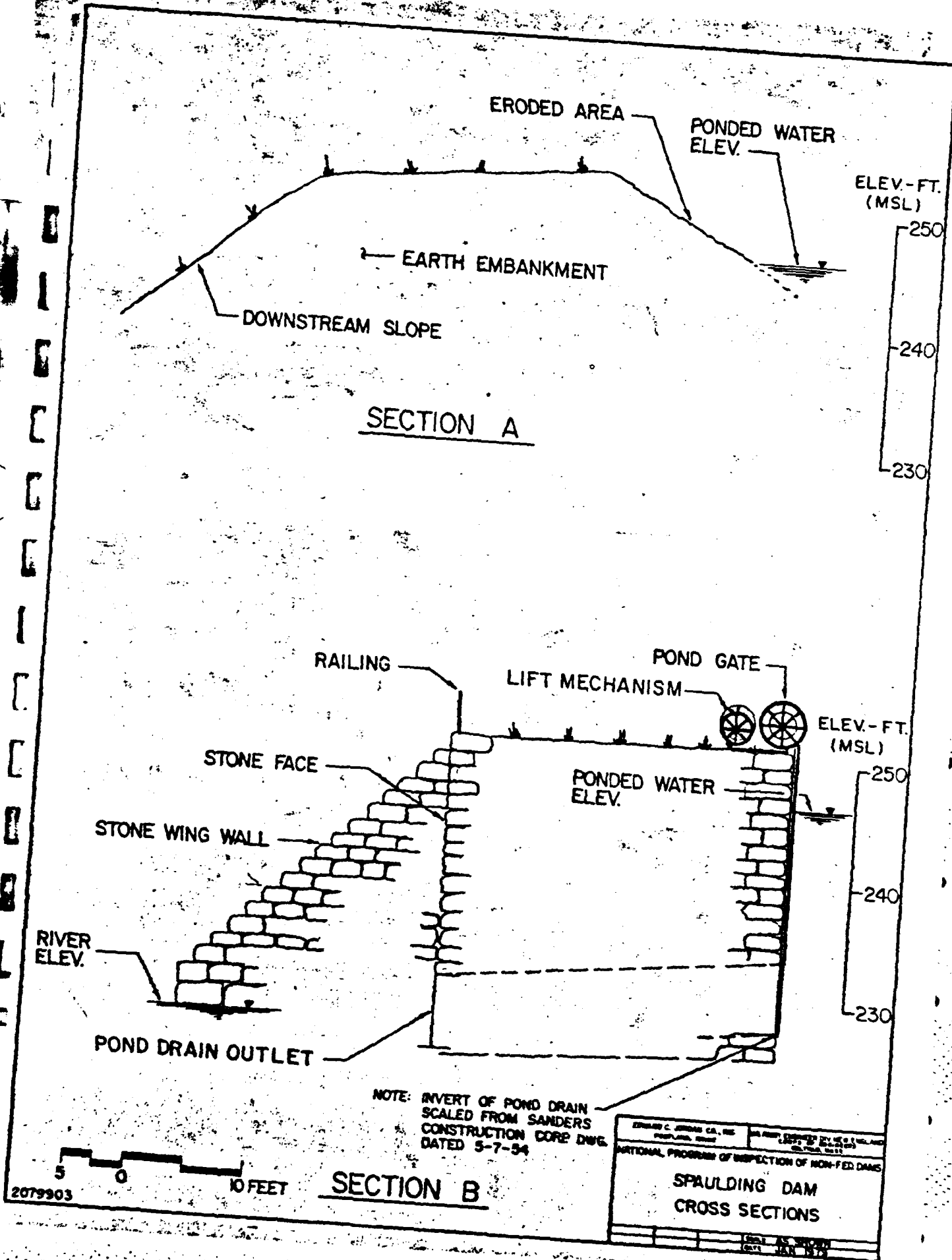
2079903

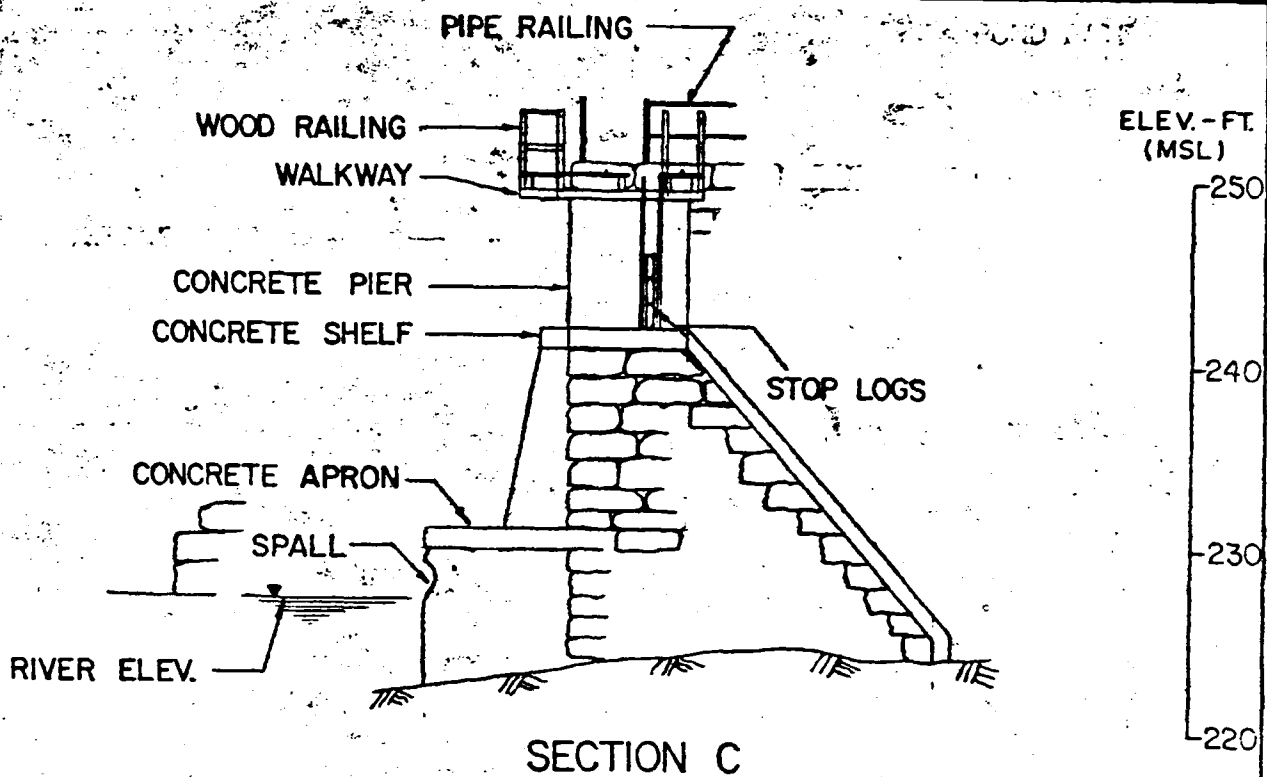


90° PHOTO ANGLES
SEE PAGE

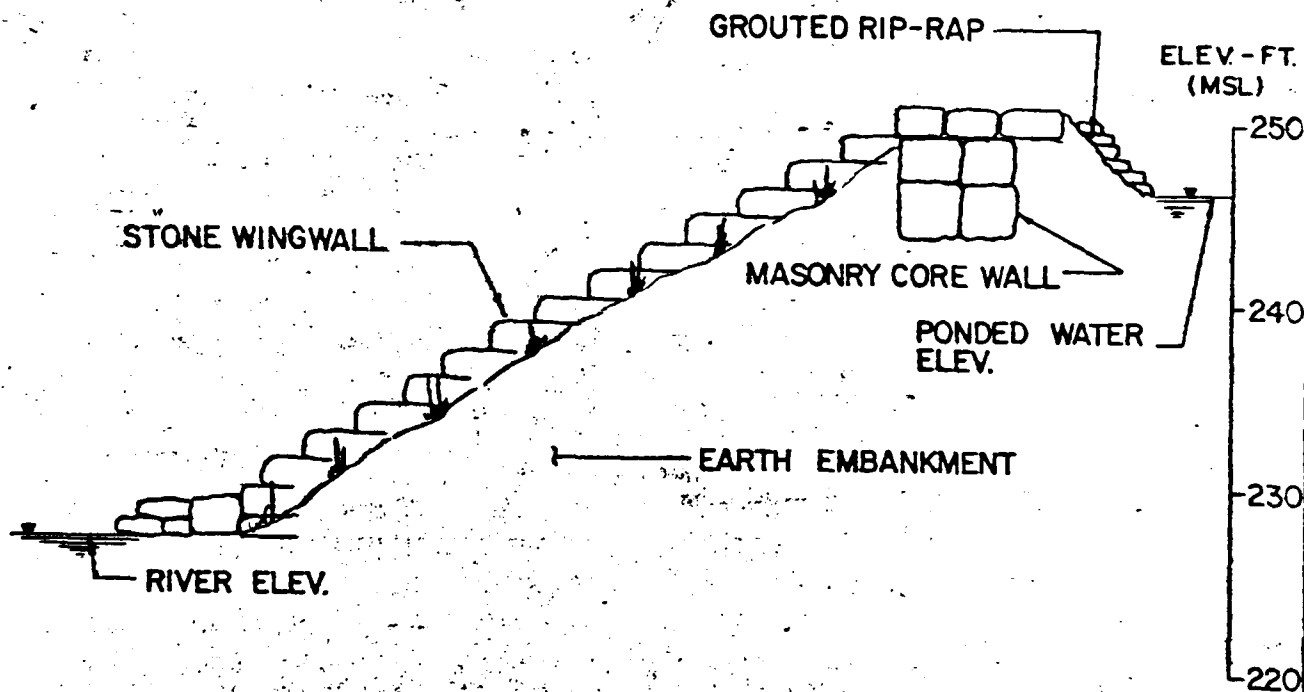


EDWARD C. JORDAN CO., INC. PORTLAND, MAINE		U.S. ARMY ENGINEER DIVISION PORTLAND, MAINE	
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS			
SPAULDING DAM PLAN AND PROFILE			
SALMON FALLS RIVER		NEW HAMPSHIRE	
DATE: JUL 1973		DATE: JUL 1973	





SECTION C



SECTION D

5 0 10 FEET

2079903

ENGINEER C. JORDAN CO., INC. PORTLAND, ORE.	INSPECTOR (MEMBER OF N.E.C.T.D. AND GROUP OF E.C.T.D.) JULY 1955
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	
SPAULDING DAM	
CROSS SECTIONS	
NO. 1	AS SHOWN
NO. 2	JULY 1955

APPENDIX B-2

PAST INSPECTION REPORTS

Attached are copies of inspection reports pertaining to the Spaulding Dam on file with the New Hampshire Water Resources Board in Concord, New Hampshire.

B-2.1
Spaulding Dam

CALCULATION SHEET

Refers to.....

3545

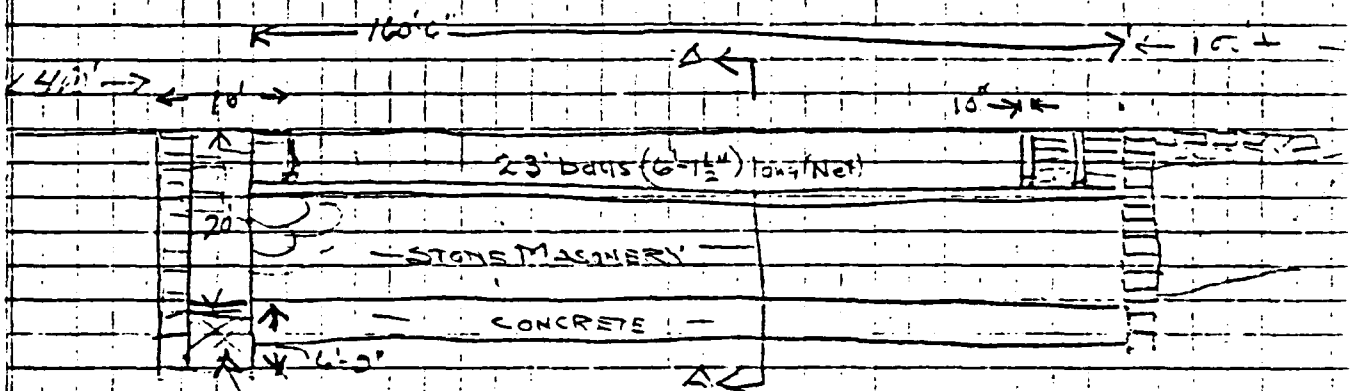
Date 11-20-35

Made By RCB

SPaulding FIBRE

1-4970

1-183 HP Letell 25'9 1/2" Head.
1-282.5 HP " " "



FLOOD GATE 7x7

1- DIKE 119' x 1 1/2' HIGH
CONCRETE CURB

1- DIKE 170' x 1 1/2'
CONCRETE CURB

COPY

Co.

CALCULATION SHEET

Date 9-20-35

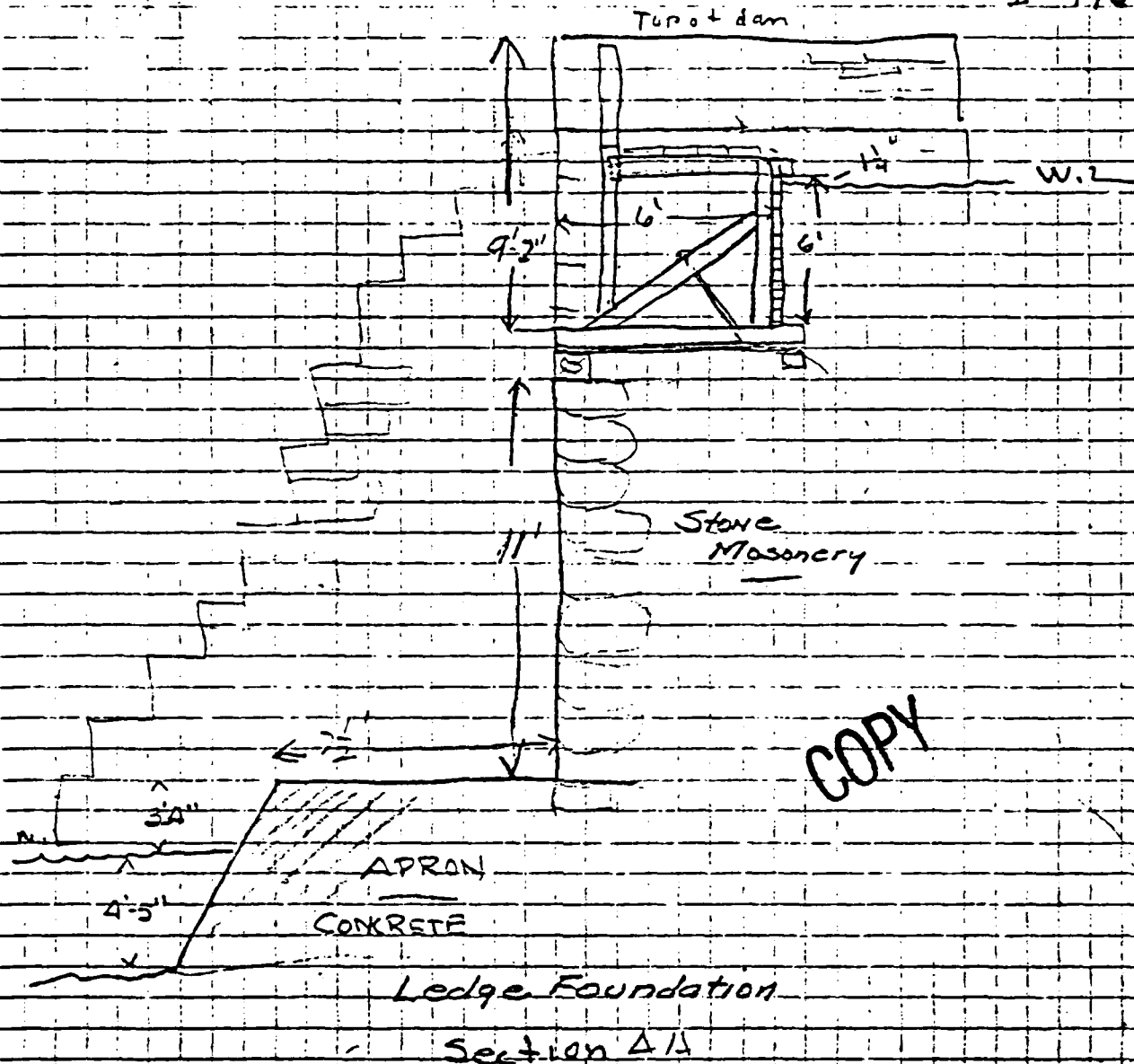
Refers to

Made By GCB

3046

SPRINDLING FIBRE CO

I-4920



COPY

NEW HAMPSHIRE WATER CONTROL COMMISSION

REPORT ON DAM INSPECTION

TOWN Rockier DAM NO. 2218 STREAM Spring Hill P. R.

OWNER Spaulding Fiber Corp. ADDRESS E. F. R. Co. 11. 11.

In accordance with Section 20 of Chapter 133, Laws of 1937, the above dam was inspected by me on _____ accompanied by 2 1/2

NOTES ON PHYSICAL CONDITION

Abutments Good

Spillway Good

Gates Not operable at time, operable on canal is

Other _____

CHANGES SINCE LAST INSPECTION None

FUTURE INSPECTIONS Yes

This dam (is) (~~is not~~) a menace because at head of pondage

REMARKS Small leak about 5' in width at base

about 12" below maximum water level

No more water from it than from other places

B-2.3

Spaulding Dam

Came to Owner Date

SPILLWAY:

Length:

16' 2" x 4' 6"

Freeboard:

4'

SEEPAGE:

Location, estimated quantity, etc.

Above Downstream gate structure

See photo

A leak 4' of water over the gate

could not inspect the spillway face

Changes Since Construction or Last Inspection:

Repaired in 1954.

Tail Water Conditions:

OK

COPY

Overall Condition of Dam:

Good

Contact With Owner:

Yes William Keen

Date of Inspection:

12/2/77

Suggested Reinspection Date

1978

Class of Dam:

Minor

Signature

J. A. D. L. L. L.

Date

12/2/77

State of New Hampshire

WATER RESOURCES BOARD

37 Pleasant Street
Concord, N.H. 03301

TELEPHONE 271-3406

February 15, 1978

Spaulding Fibre Co.
Spaulding Ave
No. Rochester, NH 03867

COPY

Gentlemen:

Under the provisions of RSA Chapter 482, Sections 8 through 15, copy enclosed, on December 2, 1977 an Engineer of the Water Resources Board inspected your dam in Rochester. This dam, #204.08, is classified in the files of this office as a menace structure and as such must be maintained in a manner not to endanger public safety nor become a dam in disrepair.

As a result of this inspection it was noted that several items of maintenance or repair are in need of attention.

1. Seepage above gate section on the downstream side.
2. Four feet of water going over the spillway at time of inspection. Therefore the spillway section to be inspected during summer months and reported to this office if it needs any repair work.

Because this dam is classified as a menace structure, we require that you send us a proposed schedule of repairs within thirty (30) days. If you have any questions, please contact us at your convenience.

Very truly yours,

George M. McGee, Sr.
Chairman

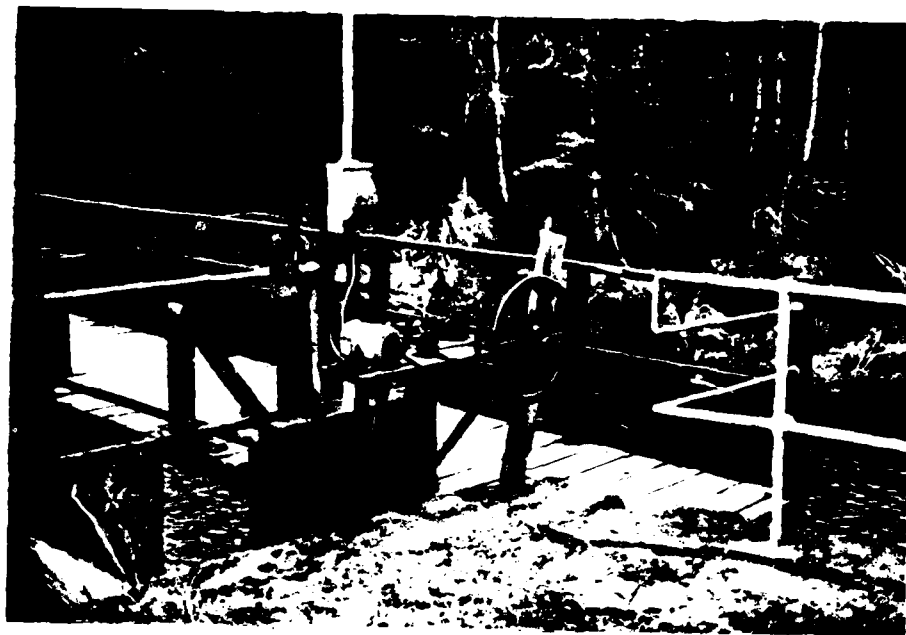
GMNG:PDK:njk

Enc.

APPENDIX C

PHOTOGRAPHS

The following are photographs referenced in this report.
See plan in Appendix B-1 for photograph locations and
orientations.



1
HOISTING EQUIPMENT
REMOTE CONTROLLED GATE



2
POND DRAIN OUTLET;
TAIL-APRON OF SPILLWAY IS AT RIGHT.
NOTE LEAKAGE THROUGH STONE-WORK;
ALSO NOTE DETERIORATION OF CONCRETE IN APRON.



3

ERODED AREA ON UPSTREAM FACE
OF SOUTH EMBANKMENT,
NEAR POND DRAIN OPERATING
EQUIPMENT.



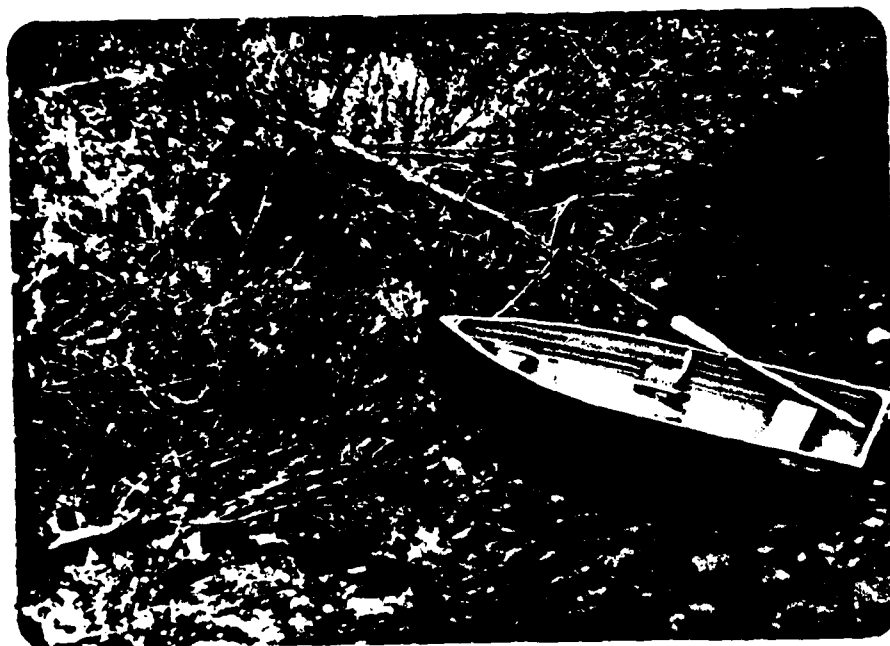
4

WALL ON SOUTH EMBANKMENT



5

VIEW ALONG NORTH EMBANKMENT
TOWARD SPILLWAY; CORE WALL
IS SEEN IN CENTER AND FOREGROUND



6

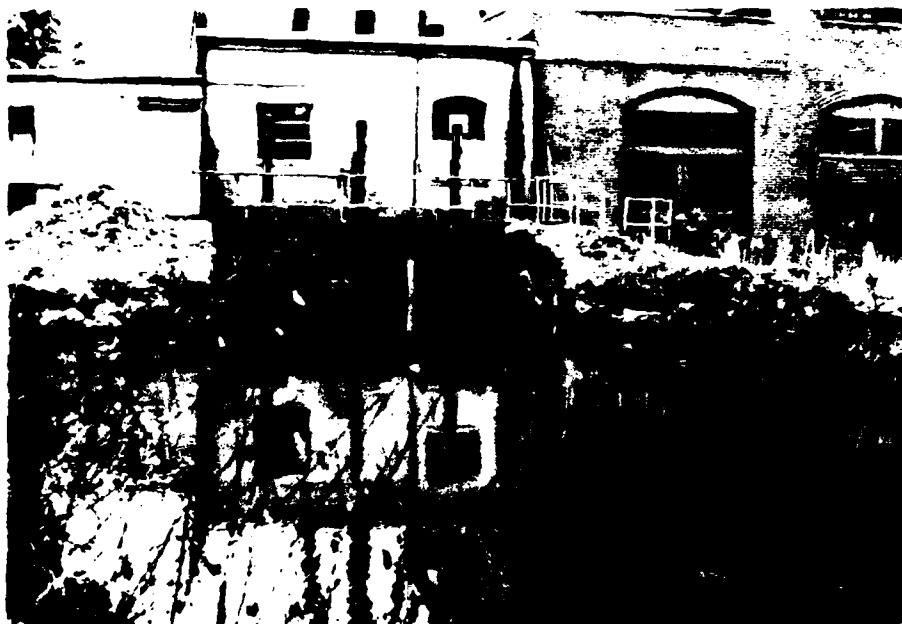
IRON SPRING ON NORTH STREAM BANK
BELOW NORTH ABUTMENT OF SPILLWAY



7
VIEW UPSTREAM FROM SERVICE BRIDGE



8
VIEW DOWNSTREAM FROM SERVICE BRIDGE



9

SERVICE OUTLET TO POWERHOUSE AT
SPAULDING FIBRE CO. MILL



10

BRIDGE OVER SALMON FALLS RIVER
BELOW DAM

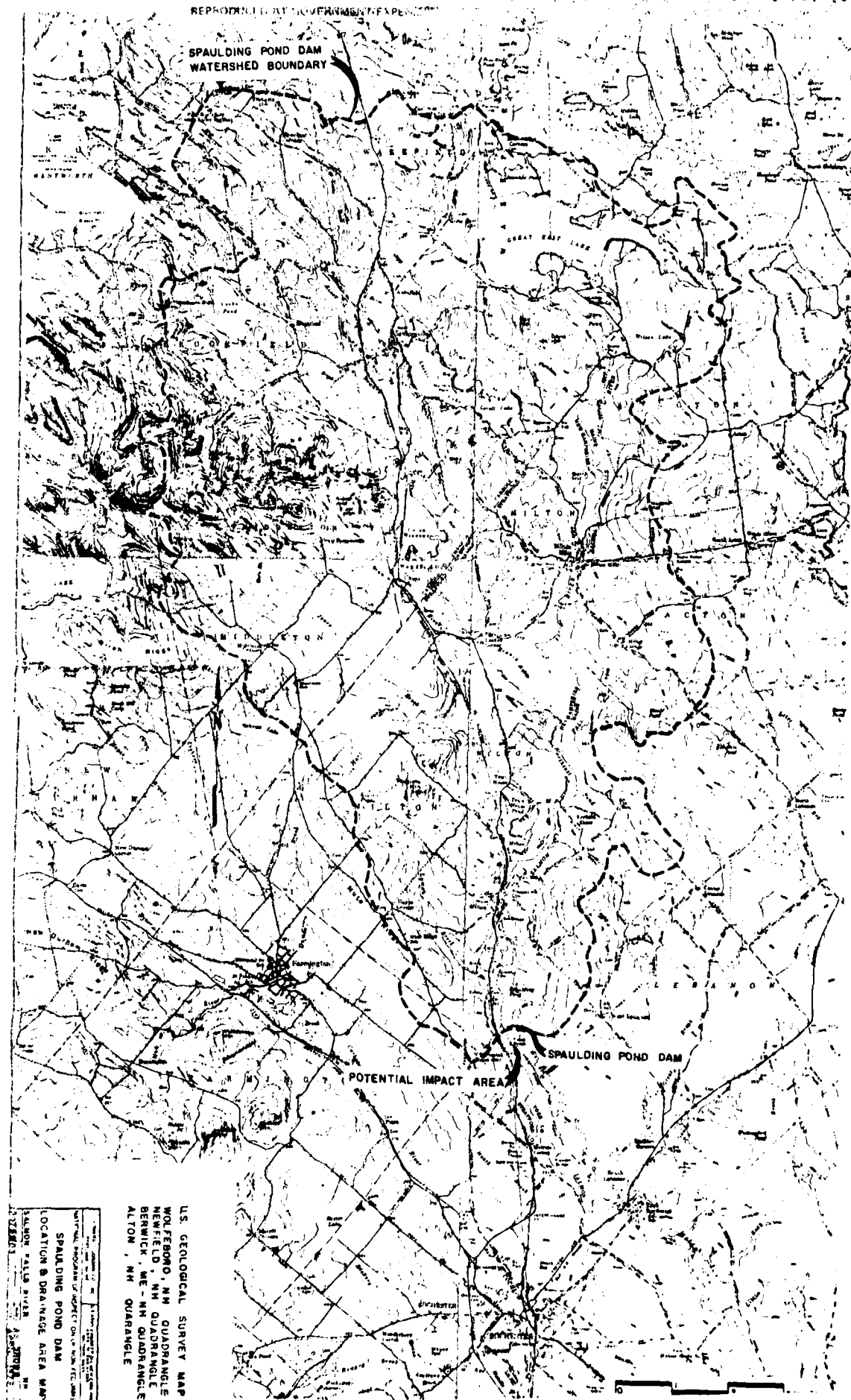


11
BRIDGE OVER OUTLET CHANNEL
FROM MILL

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Hydrologic computations pertinent to this investigation are attached. The following map shows the Salmon Falls River watershed at the Spaulding Dam.



U.S. GEOLOGICAL SURVEY MAP
WOLFEBORO, NH QUADRANGLE
BENRICK, NH QUADRANGLE
ALTON, NH QUADRANGLE
SPAULDING POND DAM
LOCATION & DRAINAGE AREA MAP
SCALE: 1:50,000
DATE: 1967

PROJECT TEST FLOOD ANALYSIS	COMP BY BTB	JOB NO. 20799 03
	CHK BY JJD	DATE 1-26-79

Flow at the Spaulding Dam is controlled by upstream reservoirs, particularly Milton Three Ponds Dam. A Phase I Inspection Report (August 1972) reported a PMF inflow to Milton Three Ponds Dam of 42,000, and a PMF outflow of 35,000 cfs. Using data from Appendix D of the report, a $\frac{1}{2}$ PMF of 21,000 cfs would be routed to 17,500 cfs. The PMF flow was computed in the Phase I Report of Milton Three Ponds Dam using the flat curve. We concur with the use of this curve.

LOCATION	PMF FLOW, CFS	$\frac{1}{2}$ PMF FLOW, CFS	D.A. ² S.F.
Milton 3 Ponds Dam	35000	17500	108.0
Spaulding Pond Dam ¹	42000	21000	118.1

¹ Intervening Area Flow calculated according to COE's "Preliminary Guidance for Estimating PMF"

² DA measured on USGS flood sheets

PROJECT VOLUME & AREA CALCS.	COMP BY BTE	JOB NO. 20799 03
	CHK BY JJD	DATE 1-26-79

Spaulding Pond Area:

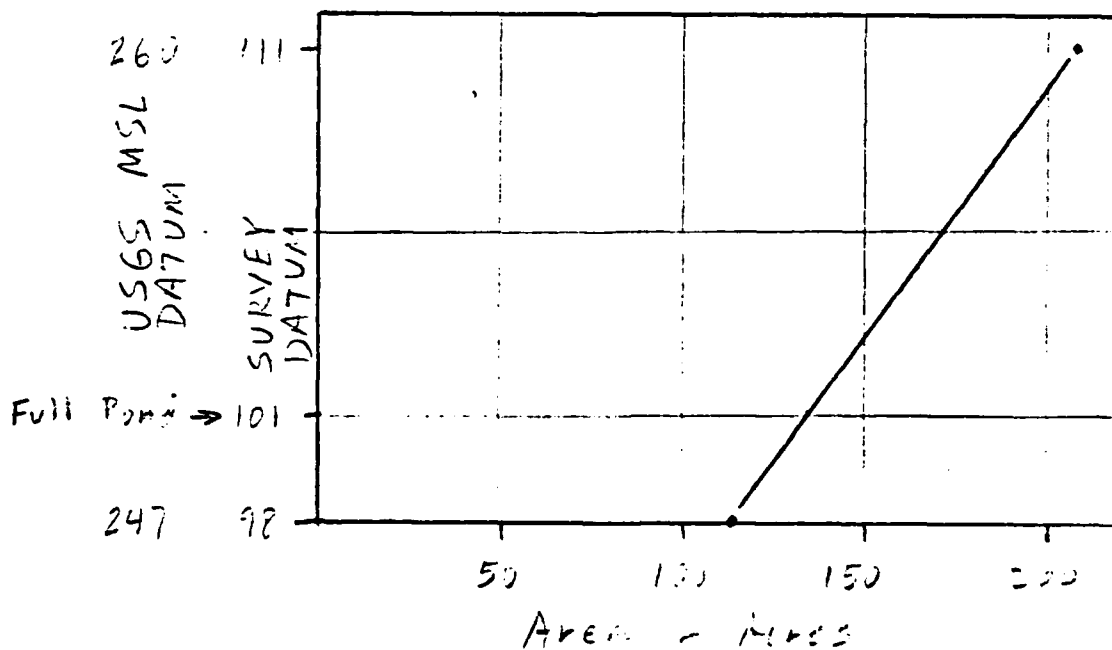
@ Normal Pond (El 247) = 0.175 Sq Mi.
or 11300 acs

@ El 260 = 0.327 Sq Mi.
or 209 acres

Impounding Capacity:
(according to COE Inventory
of Dams 15 SEP 78)

normal = 325 acre-ft

maximum = 1125 acre-ft



PROJECT VOLUME & AREA CALCS.	COMP BY	JOB NO.
	BTB	20799 03
	CHK BY	DATE
	JD	1-26-79

check COE Inventory Capacities:

Normal Capacity (@ 98') -

$$(112 \text{ acres}) \left(\frac{1}{2} \right) (10') = 5600 \text{ ac-ft}$$

use 325 according to COE
inventory sheet.

Maximum Capacity (@ 101'):

$$32500 \text{ ac-ft} + \left(\frac{112+135}{2} \right) (101-98) \\ = 700 \text{ ac-ft}$$

∴ 1125 much too high use 700 ac-ft

Elev. 105:

$$700 \text{ ac-ft} + \left(\frac{135+165}{2} \right) (105-101) \\ = \underline{1300 \text{ ac-ft}}$$

Elev. 110:

$$1300 + \left(\frac{165+200}{2} \right) (110-105) \\ = \underline{2212 \text{ ac-ft}}$$

PROJECT

STORAGE - DISCHARGE CURVE

COMP BY
BSTB

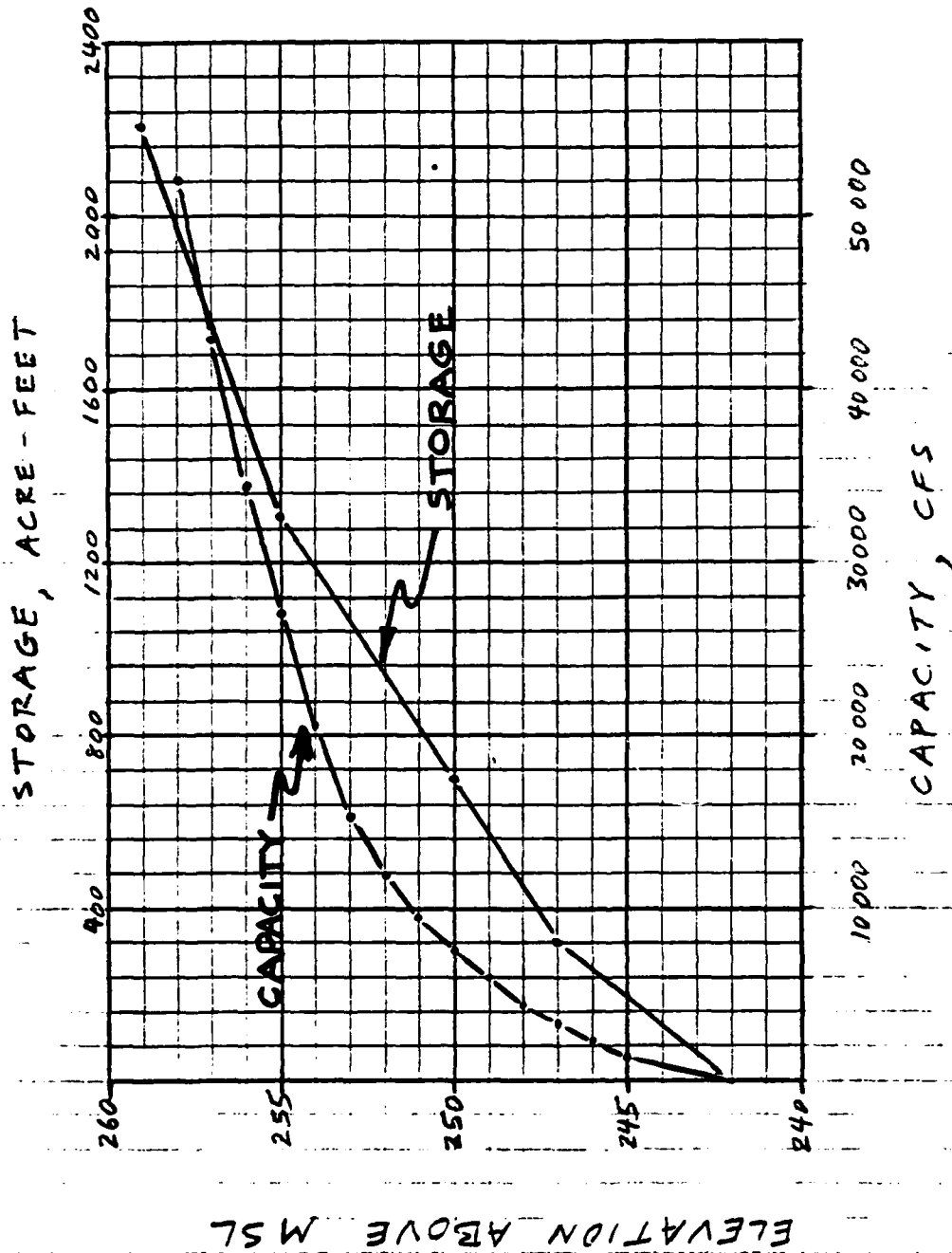
CHK BY

JOB NO.

20799 03

DATE

5-23-79



D-5

Spaulding Dam

PROJECT EFFECT OF SURCHARGE STORAGE ON PMF	COMP BY BTB	JOB NO. 20799 03
	CHK BY CSD	DATE 1-26-79

$$PMF = 42000 \text{ CFS} = Q_{p1}$$

$$\text{Elev. to pass } Q_{p1} = 107.9'$$

$$STOR_1 = 1800 - 325 = 1475 \text{ AL-FT}$$

$$s = \frac{1475}{118.1 \times 640} \times 12 \text{ in} = 0.23''$$

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR_1}{19}\right)$$

$$= 42000 \times \left(1 - \frac{0.23}{19}\right) = 41482$$

$$\text{Elev. to pass } Q_{p2} = 107.8'$$

$$STOR_2 = 1680 - 325 = 1355$$

$$s = \frac{1355}{118.1 \times 640} \times 12 = 0.22''$$

$$Q_{p3} = 42000 \times \left(1 - \frac{0.22 + 0.23}{19}\right)$$

$$Q_{p3} = 41,502 \text{ CFS} \approx \underline{\underline{41,500 \text{ CFS}}}$$

$$\text{Elev. to pass } Q_{p3} = \underline{\underline{107.8'}}$$

PROJECT EFFECT OF SURCHARGE STORAGE ON $\frac{1}{2}$ PMF	COMP BY BTB	JOB NO. 20799 03
	CHK BY JSD	DATE 1-26-79

$$\frac{1}{2} \text{ PMF} = 21000 \text{ CFS} = Q_{p1}$$

$$\text{Elev. to pass } Q_{p1} = 105.1$$

$$\text{STOR}_1 = 1200 - 325$$

$$or = \frac{875}{118.1 \times 640} \times 12 = 0.14$$

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{\text{STOR}_1}{9.5}\right)$$

$$= 21000 \times \left(1 - \frac{0.14}{9.5}\right) = 20693$$

$$\text{Elev. to pass } Q_{p2} = 105.0$$

$$\text{STOR}_2 = 1180 - 325 =$$

$$or = \frac{855}{118.1 \times 640} \times 12 = 0.14$$

$$Q_{p3} = 21000 \times \left(1 - \frac{0.14}{9.5}\right)$$

$$Q_{p3} = 20693 \text{ CFS} \approx \underline{\underline{20,700 \text{ CFS}}}$$

$$\text{Elev. to pass } Q_{p3} = \underline{\underline{105.0}}$$

PROJECT SPAULDING DAM HYDRAULICS	COMP BY BTB	JOB NO. 20799 03
	CHK BY JTD	DATE 1-25-79

WEIR DESIGNATION	SURVEY DATUM ELEV.	LENGTH	C	M.S.L. DATUM ELEV
N. Spillway	97.0*	106.	varies	246.0
S. Spillway	97.6*	30	"	247.6
Piers	100.0	20	"	249.0
N. Embankment	102.0	120	2.5	251.0
S. Embankment E	101.3	32	2.2	250.3
S. Embankment B	104.0	430	2.5	253.0
S. Embankment (man-made dike sections)	102.4	200	2.5	251.4

* ELEV @ 15.0 without stoplogs.

5-40 HANDBOOK OF HYDRAULICS
KING & BRATER

Table 5-3. Values of C in the Formula $Q = CLH^{3/2}$ for Broad-crested Weirs

Measured head in feet, H	Breadth of crest of weir in feet													
	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00	15.00			
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68			
0.4	2.92	2.80	2.72	2.64	2.61	2.60	2.58	2.54	2.50	2.56	2.70			
0.6	3.08	2.89	2.75	2.64	2.61	2.60	2.68	2.69	2.70	2.70	2.70			
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.68	2.69	2.64			
1.0	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63			
1.2	3.32	3.20	3.06	2.86	2.70	2.65	2.64	2.67	2.66	2.69	2.64			
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64			
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63			
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63			
2.0	3.32	3.31	3.30	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63			
2.5	3.32	3.32	3.31	3.26	3.07	2.89	2.81	2.72	2.67	2.64	2.63			
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.64	2.63			
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63			
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.64	2.63			
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63			
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63			
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63			

PROJECT HYDRAULICS	COMP BY BTB	JOB NO. 20799 03
	CHK BY JJD	DATE 1-25-79

SURVEY DATUM ELEV	S. EMBANKMENT B Q CFS	S. EMBANKMENT B Q CFS	S. EMBANK. (man-made section) Q CFS
97	—	—	—
98	—	—	—
99	—	—	—
100	—	—	—
101	—	—	—
102	49	—	—
103	187	—	232
104	373	—	1012
105	597	1000	2096
106	858	2225	3415
107	1145	3176	4933
108	1460	6000	6670
109	1798	11180	8478
110	2160	14677	10476

PROJECT HYDRAULICS	COMP BY	JOS NO.
	BTB	20799 03
	CHK BY	DATE
	JJ	1-25-79

WITH STOPLOGS AS
THEY WERE DURING FIELD INSPECTION

SURVEY DATUM ELEV.	N. Sp. Hwy. Q CFS	S. Sp. Hwy. Q CFS	RECS Q CFS	N. Embankment Q CFS
97	—	—	—	—
98	352	—	—	—
99	995	27	—	—
100	1829	165	—	—
101	2815	370	54	—
102	3935	624	150	—
103	5172	717	276	300
104	6518	1250	432	849
105	7963	1613	624	1559
106	9502	2205	847	2400
107	11129	2425	1067	3354
108	12839	2770	1303	4407
109	14629	3340	1555	5556
110	16485	3834	1821	6787

PROJECT HYDRAULICS	COMP BY BTD	JOB NO. 20799 03
	CHK BY JJD	DATE 1-26-79

STOPLOGS REMOVED
FROM 6 BAYSSTOPLOGS
IN PLACE AS DURING
VISUAL INSPECTION

SURVEY DATUM ELEV	MSL DATUM ELEV	N. Spillway & CFS	S. Spillway & CFS
93	242	—	—
94	243	189	80
95	244	530	225
96	245	977	415
97	246	1526	648
98	247	2322	936
99	248	3323	1275
100	249	4379	1600
101	250	5544	1955
102	251	6807	2333
103	252	8160	2732
104	253	9592	3152
105	254	11114	3572
106	255	12707	4050
107	256	14370	4526
108	257	16103	5019
109	258	17902	5520
110	259	19764	6056

NOTE:

SERVICE BRIDGE
HAS BEEN
REMOVED FROM
THE AREA OVER
THE LAST 3 BAYS
ON THE NORTH
OF THE DAM

PROJECT HYDRAULICS	COMP BY BTB	JOB NO. 2079903
	CHK BY JSD	DATE 1-25-79

SURVEY DATUM ELEV	MSL DATUM ELEV	TOTAL FLOW WITHOUT STOPLOGS ¹ CFS	TOTAL FLOW WITH STOPLOGS ² CFS
93	242	—	—
94	243	269	—
95	244	755	—
96	245	1392	—
97	246	2174	—
98	247	3252	352
99	248	4593	1017
100	249	5979	1764
101	250	7552	3239
102	251	9339	4752
103	252	11827	7036
104	253	15416	10434
105	254	20524	15454
106	255	27105	21255
107	256	34521	29249
108	257	42920	37507
109	258	51997	46526
110	259	61762	56271

¹ STOPLOGS OVER NORTHERLY BAYS OF SPILLWAY

² AS STOPLOGS WERE SET ON 11-14-77, DAY OF INSPECTION

NOTE: FOR TOTAL PROJECT FLOW, ADD 200 CFS TO TOTAL FOR MAX. FLOW DISCHARGED BY CHAM GATES, AS REPORTED BY SPAULDING FERRIS CO.

PROJECT Dam Failure Hydrographs	COMP BY BTB	JOB NO. 20799 03
	CHK BY (S)	DATE 1-26-77

$$Q_{p1} = 8/27 W_b \sqrt{g} Y_0^{3/2} \left. \begin{array}{l} \text{From attachment} \\ \text{to ETL 1110-2-234} \end{array} \right\}$$

$$\frac{1}{2} Q_p T = 12.1 S$$

FAILURE TO BE EXPLODED NEAR DAM
THROUGH SOUTHERLY EARTH EMBANKMENT

$$Y_0 = 101 - 82 = 19$$

$$W_b = 40'$$

$$Q_{p1} = 8/27 (40) \sqrt{g} (19)^{3/2} = 5500 \text{ cfs}$$

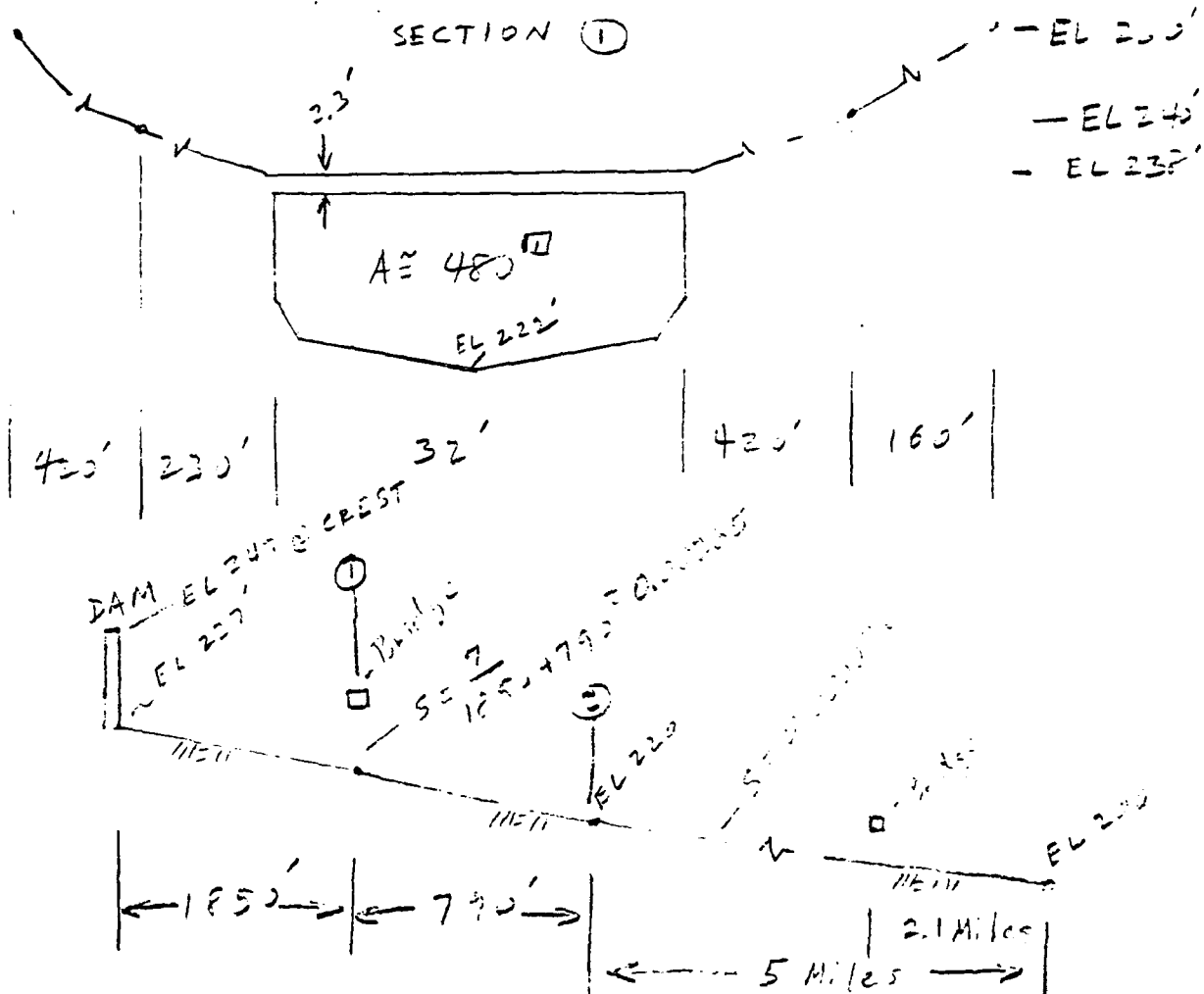
= 5500 cfs +
flow over dam

$$\text{Flow over dam (without stoplogs)} \\ = 7553$$

$$\text{Total } Q_{p1} = 5500 + 7553 = \underline{\underline{13,200 \text{ cfs}}}$$

$$S = 700 \text{ Ac.-ft}$$

$$T = \frac{12.1 (700)}{\frac{1}{2} (13,200)} = \underline{\underline{1.25 \text{ hours}}}$$



Y-SECTION & SLOPE FROM USGS QUALITY.
 $n = 0.035$ for channel, or $n = 0.06$ for
 composite of overbanks & channel.

PROJECT Dam Failure Hydrographs	COMP BY	JOB NO.
	BTB	2079903
	CHK BY (55)	DATE 1-29-79

	Bridge 1850' below Dam	
<u>ELEV</u>	<u>FLOW¹ CFS</u>	<u>STORAGE Ac-Ft</u>
238	4089	20
240	6333	50
243	10144	141
244	14719	176
245	19938	211

1 Pressure Flow through bridge opening.
 $Q = CA\sqrt{2gh}$; $Q = 1.485AR^{2/3}S^{1/2}$ for overbanks
 At higher Elevations (240+), there would
 likely be a very small head available for
 press. flow, so use Manning's Formula.

PROJECT Dam Failure Hydrographs	COMP BY BTD	JOB NO. 20799 03
	CHK BY JJD	DATE 1-29-79

Q_{p2} - Downstream Bridge

$$Q_{p1} = 13,200 \text{ CFS}$$

$$Q_{p2} @ \text{EL } 243.7$$

$$V_1 = 164 \text{ AC-FT}$$

$$Q_{p2} (\text{TRIAL}) = Q_{p1} \left(1 - \frac{V_1}{S}\right)$$

$$Q_{p2} (\text{TRIAL}) = 13,200 \left(1 - \frac{164}{700}\right) = 10,107$$

$$Q_{p2} (\text{TRIAL}) @ \text{EL } 243.0, V_2 = 141.0'$$

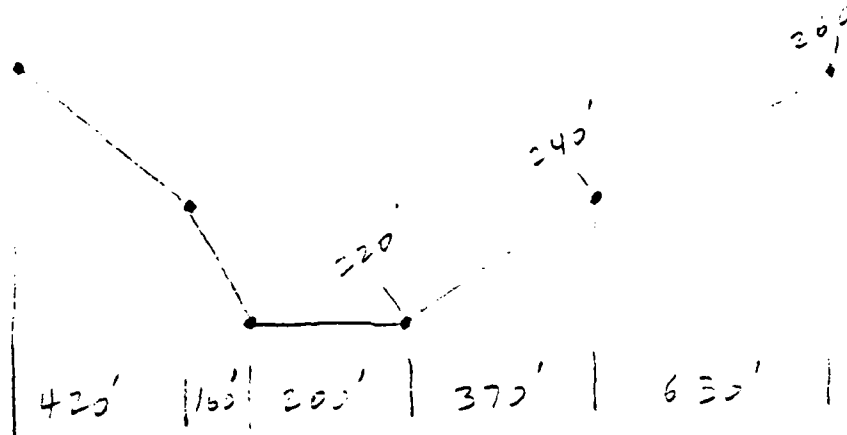
$$Q_2 = Q_{p1} \left(1 - \frac{V_{\text{AVE}}}{S}\right)$$

$$= 13,200 \left(1 - \frac{152.5}{700}\right) = \underline{\underline{10,325 \text{ CFS}}}$$

$$@ \underline{\underline{\text{EL } 241.0'}}$$

WAVE HEIGHT = 19' OR
ABOUT 3' ABOVE THE
BRIDGE ROADWAY

PROJECT Dam Failure Hydrographs	COMP BY BTE	JOB NO. 2079903
	CHK BY ---	DATE 1-30-79



X-SECTION ②
 ② 790' downstream of X-SECTION ①
 ② 220' contour

$$S = 0.00005, n = 0.06$$

ELEV

FLOW, CFS

STORAGE
AC-FT

227
 226
 224
 220

7962
 10239
 12254
 15735

37
 44
 52
 60

PROJECT Dam Failure Hydrographs	COMP BY BTB	JOB NO. 2079903
	CHK BY JED	DATE 1-30-79

$$Q_{p2} = 10,325 \text{ @ X-SECTION ①}$$

$$Q_{p3} \text{ @ EL } 228.0$$

$$V_1 = 44 \text{ AC-FT}$$

$$Q_{p3}(\text{TRIAL}) = 10325 \left(1 - \frac{44}{700}\right)$$

$$Q_{p3}(\text{TRIAL}) = 9676 \text{ CFS @ EL } = 227.7'$$

$$V_2 = 42 \text{ AC-FT}$$

$$Q_{p3} = 10325 \left(1 - \frac{43}{700}\right) = 9690 \text{ CFS}$$

$$\text{@ EL } 227'$$

$$\text{OR Height} = 7.7'$$

The distance downstream to the nearest habitable structure is about 4 miles.

The flood plain downstream of x-sect. ② is broad and contains much storage capacity.

There is a possibility of damage to 2 houses at x-sect. ① and the associated possible loss of life.

The flooding would nearly be contained within the river banks at x-section ② and would cause no damage to the protection.

PROJECT

Dam Failure Hydrographs

COMP BY

BTD

JOB NO.

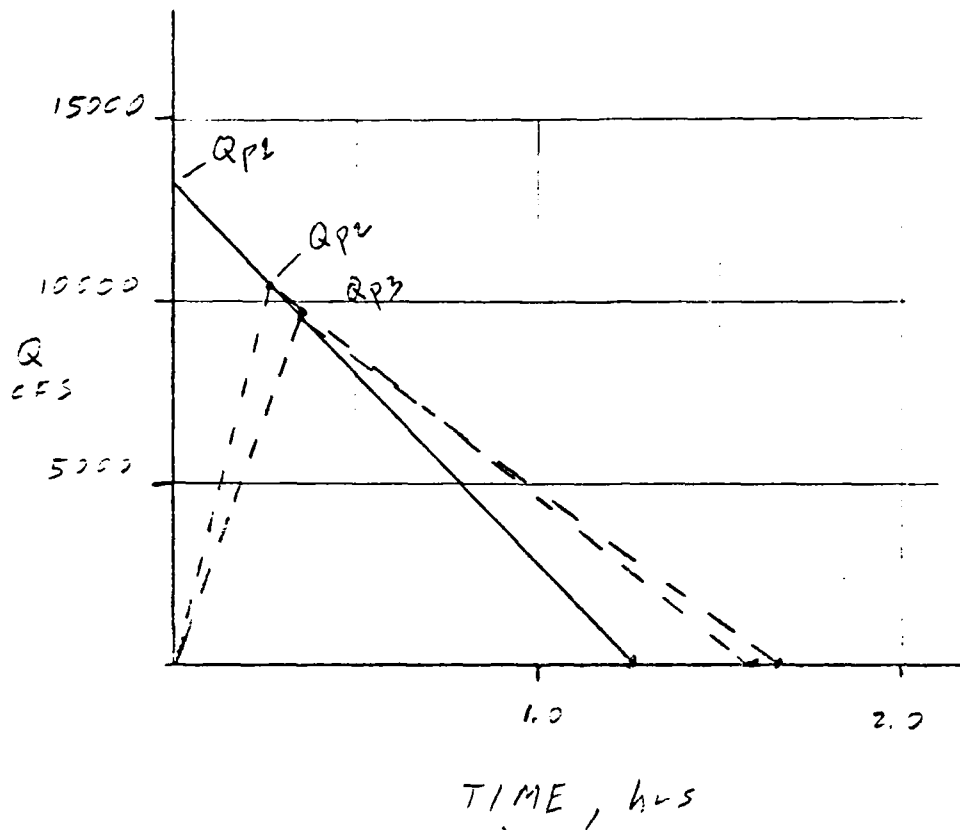
20799 03

CHK BY

ED

DATE

1-30-79

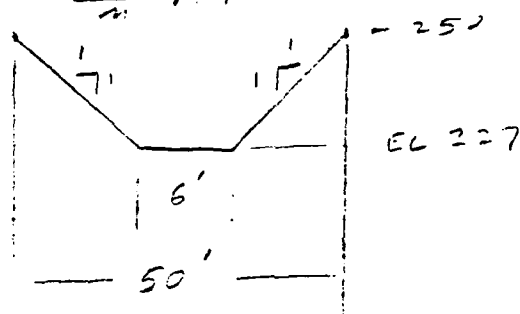


PROJECT Dam Failure Hydrographs	COMP BY BTB	JOB NO. 20799 03
	CHK BY JJD	DATE 2-27-79

FAILURE TO BE EXPLORED NEAR
CANAL OUTLET WORKS

CHECK CAPACITY OF CANAL

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$



$S = 0.00265$ in vicinity of dam
 $n = 0.035$

$$A = 667$$

$$Q = \frac{1.486}{0.035} (667) \left(\frac{667}{71} \right)^{2/3} (0.00265)^{1/2}$$

$Q = 6374 \text{ CFS}$ ∴ CANAL IS NOT
A CONSTRICTION

IF A FAILURE OCCURRED NEAR
THE CANAL OUTLET WORKS, IT MAY
BE ASSUMED THAT FLOWS WOULD
BE OF THE SAME MAGNITUDE
THAT WOULD OCCUR IF A FAILURE
OF THE EARTH EMBANKMENT NEAR
THE DAM.

APPENDIX E
INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	DIVISION	CONGR. DIST.	STATE	COUNTY	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE
NH	390	RED	NH	117	01	SPAULDING DAM	4322.7	7059.0	24 APR 74

POPULAR NAME	NAME OF IMPONDMENT		
SPAULDING DAM	SPAULDING POND		
REGION	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	POPULATION
1	SALMON FALLS RIVER	RUCHESTER NH	25000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRAINING CAPACITY (GPM)	HYDRAULIC HEIGHT (FT.)	MAXIMUM FLOODING CAPACITY (ACFT)	NORMAL FLOODING CAPACITY (ACFT)	LIST OWN	FEED N	PHY/PEP	SCS A	VEN/DAL
2	1997	H	32	30	700	525	N	N	N	N	24 APR 74

REMARKS											
21-3106 HASURNY, CONC 1-NH20408 22-MAJOR REPAIR 1954											
D/S BAS	SPILLWAY	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CU)	POWER CAPACITY (KW)	INSTALL COST (\$)	REPAIR COST (\$)	NAVIGATION LOCKS	NO. OF LOCKS	LOCK LENGTH (FT)	LOCK WIDTH (FT)	LOCK DEPTH (FT)
2	2100	157	8100								

OWNER	ENGINEERING BY	CONSTRUCTION BY
SPAULDING PINE CO	I W JONES	SANDERS CONSTRUCTION CO

REGULATORY AGENCY	
DESIGN	OPERATION
11 WATER RES BD	11 WATER RES BD

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
FORWARD C JORDAN CO INC	1400070	PUBLIC LAW 92-367 AUG 1972

REMARKS
1-1 STOP LOG BAYS + 3 VENT. LIFT GATES

END

FILMED

8-85

DTIC